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ABSTRACT

This report suggests feasible alternatives to the present methods of calculating benefits and costs of the joint federal-state vocational rehabilitation program. "Summary and Guide to Reading This Report" (Monroe Berkowitz) appears first. Part I, Background, Theory and Models, includes "The Cost Benefit Tradition in Vocational Rehabilitation" (Edward Berkowitz), "Welfare Measurement for Benefit Cost Analysis" (Douglas Blair and William Milberg), "Benefit Cost Models" (Jack Worrall), and "Models Based on Individual Behavior" (Duncan Mann). Part II, Benefit Cost Analysis using R-300 Data, contains "The R-300 Data Set" (Ernest Gibbs and Anita Hall-Kane), "Simple Benefit Cost Ratios" (Ernest Gibbs), "Benefit Cost Ratios using Multivariate Analysis" (Ernest Gibbs), "Correcting for Zero Wages at Referral" (Anlta Hall-Kane), and "Inputting Benefits to Persons Closed Not Rehabilitated" (David Dean and Robert Dolan). In Part III, Activity at the State Level, the chapters are "Benefit Cost Analyses Conducted by State Agencies" (Frederick Collignon) and "Collection of Data by State Agencies" (Stanley Portny). Part IV, Using Augmented Data Bases, includes "Using a Better Measure for Services" (David Dean and Robert Dolan), "Using Better Measures of Disability Status" (David Dean and William Milberg), "A Mini-Data Link" (David Dean and Robert Dolan), and a conclusion by Monroe Berkowitz. (YLB)

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ANALYSIS OF COSTS AND BENEFITS IN REHABILITATION

Final Report

December 1985

Department of Education

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A NEW BENEFIT-COST REPORT

This report, "Analysis of Costs and Benefits in Rehabilitation," was prepared for the Office of Program, Budget and Evaluation of the U.S. Department of Education. Our task was to suggest alternatives to the present methods of calculating benefits and costs of the joint federal-state program.

The report is in four parts. The first examines the tradition of cost-benefit analysis in this program and the basic foundations of the method in welfare economics. It then reviews pertinent cost-benefit models and develops a new model.

Part II looks at the R-300 data, the basic data source for the program. We sample the data, run simple and more complex benefit-cost analyses utilizing various econometric and "cook book" methods. While we do not claim we have done everything with the data that could possibly be done, we conclude that we have reached an effective end of the road and we are not satisfied with the results.

There are more data available than are reported on the R-300 forms and, in part III, we report on what states are collecting and how they are using these data. The chapters in part IV use an augmented state data base and show how better measures of services and of disability status are possible. Most exciting is

our report on the first results of linking the R-300 records in one state with earnings data from the state employment service.

In the concluding chapter we set forth our alternatives. Our preference is for an experimental design utilizing vouchers so that no applicant need be denied services. We present other posibilities including the data link at the national level.

We apologize for the length of this report but believe that we have cleared away a lot of the underbrush surrounding discussion of this issue. The report begins with a summary and a guide to reading the report which is designed to make the task of the reader a bit easier.

Although we are unable to list individual names, we acknowledge our debt to each of the persons who worked on this and the other studies, as well as to countless persons in the state and federal agencies who have so kindly supplied us with data, information and insights. Our familiarity with the dedication of workers in the field strengthens our confidence in the vocational rehabilitation program. The development of sound, objective measures of costs and benefits should help confirm that confidence.

New Brunswick, N.J.
December 15, 1985

Monroe Berkowitz

ANALYSIS OF COSTS AND BENEFITS IN REHABILITATION

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SUMMARY AND A GUIDE TO READING THIS REPORT

Monroe Berkowitz*

THE PROBLEM

The question can be asked in a thousand ways. Does rehabilitation do any good? Do people benefit from rehabilitation? If people do receive benefits from participating in a vocational rehabilitation program, are these benefits greater than the costs? What are the net effects of this program which is currently funded by the federal government to the tune of $1.1 billion?

It is slightly amazing that we cannot find unambiguous answers to these questions about this joint federal state program. The claims made in countless speeches and pronouncements that the program returns ten or twelve dollars to the taxpayer for each dollar expended cannot hold up under analytical scrutiny.

The purpose of this report to the Department of Education is to suggest feasible alternatives for the evaluation of the benefits and costs of the program.

*Professor of Economics, Rutgers University and Project Director

Part I

BACKGROUND, THEORY AND MODELS

The Cost Benefit Tradition in Vocational Rehabilitation

We begin our report with an examination of the cost benefit tradition in vocational rehabilitation. Over the years, those concerned with the program have unabashedly proclaimed its economic virtues in specific benefit cost terms. Vocational rehabilitation was one of the first of the public programs to collect and publish data on the results of its endeavors. The language of benefit cost analysis was used in testimony before Congress and in the publications of RSA and it was used effectively. As the program expanded, the rhetoric changed in accordance with the demands of the times, but the methodology failed to keep pace.

Before and After Comparisons Are Misleading

It now seems clear that the benefit cost ratios were based on fairly naive assumptions. The ratios were calculated by taking the difference between the earnings clients reported at acceptance and their earnings at closure. Since so many persons came to the program with zero earnings, it was not difficult to report impressive cost benefit ratios. Also, to make matters worse, or better from the point of view of the programs' partisans, it was simply assumed that whatever earnings were

reported at closure would continue. When other manpower and similar programs turned to more sophisticated methods of analysis, the vocational rehabilitation program clung to its before and after comparisons which proved so effective in garnering support for the program. Chapter 1 of this report traces the uses of benefit cost analysis in vocational rehabilitation over the years.

The Demand for Better Methods

Times have changed and with the changing times have come new methods of assessing program outcomes. Evaluation has developed almost into a separate discipline. Budgetary authorities at the state and federal levels are demanding evaluations based on control group comparisons, or, at least, the use of statistical methodologies which control for the endowments and human capital that clients bring to the program.

Benefit Cost Analysis--the Basic Economic Theory

Chapter 2 moves off into the basic theory underlying all benefit cost measures. We go, as it were, from mundane aspects of the administrators' uses of benefit cost data to the arcane reaches of economic theory where we explore the rather shaky foundations of benefit cost analysis in welfare economics. When we cite a single benefit cost ratio for the entire vocational rehabilitation program, we are adding up the benefits for more than 300,000 persons. There are theoretical difficulties in such

an aggregation. There are even problems in measuring benefits accruing to an individual. Several ways to handle the difficulties are explored. Alternative conceptions of benefits, such as "willingness to pay" are of special interest in vocational rehabilitation where a market for private services is developing.

There are several reasons to discuss the theoretical foundations of benefit cost analysis. Critics of benefit cost analysis deprecate this method claiming that benefit cost analysis is more of an art than a science. They criticize the imprecision of the benefits measure and, perhaps, note the arbitrariness of some of the parameters, such as the rate of discount chosen. These may all be valid criticisms, but, in a sense, these are trivial criticisms. The basic problems lie in the precarious theoretical foundations. Our purpose in including this discussion is not to dwell on the shortcomings nor to advocate that we stop using this measure of public programs. Our belief is that this measurement tool will become more valuable once the basic assumptions on which it rests are made explicit.

Benefit Cost Models and the Data Link

Chapter 3 examines various models of benefit cost analysis beginning with the implicit models used in the traditional analysis, through Ronald Conley's pioneering work and the variants that have been published since. This chapter serves as

a type of literature review but it is a great deal more than that. As is pointed out in that chapter, program evaluators have never had the luxury of a randomly assigned treatment and control group. Instead, they have had to resort to nonexperimental designs to fashion comparison groups. The several models of this type used in vocational rehabilitation and other programs to estimate the treatment effect are reviewed as are the Social Security Administration-Rehabilitation Services Administration data link studies. The data link would have enabled estimation of the fixed effects model were the data tapes still available. A new data link would fill this void and might be useful even given the confidentiality requirements. The uses of new data link information and the limitations on its uses are explored.

A good deal could be done if the data link information were available in a machine readable form at the level of individual records. With such data, using modern econometric techniques, we could provide more accurate estimates of wage gains attributable to the program. This would be a major step forward in evaluating the rehabilitation program. (In Chapter 14, we present some results using information from what we might call a mini-data link since it relates one state's VR records with the wage information obtainable from the state's employment service records).

Why Do Clients Use Rehabiliation Services?

Chapter 4 builds upon a model currently being used in the analysis of the VR programs in three states. (This work is being supported under NIHR grant no. 133AH30005). The model is based upon the economic theory explored in Chapter 2. It suggests fashioning a control group of individuals accepted into the program who did not receive any services as would be consistent with some of the requirements set forth in Chapter 3. It is recognized that this is not an ideal control group, but it is the best of several alternatives.

In this model of individual behavior, the participants in the rehabilitation process are expected to maximize their individual utility functions. A client's utility function is based, not only on expected earnings, but also on possible improvements in his functioning and adaptability. Clients voluntarily choose to enter the program when the expected utility of participation is greater than the client's status-quo position. The client's decision essentially is to determine how long to stay in the program. The counselor's decision is concerned with the mix of services to be offered and the determination of when the client should leave the program. The interaction of these decisions determine the clients to be served and the types of services to be given. These rather complex theoretical relationships are worked out in this chapter.

Our development of this model based on individual behavior

is complementary rather than competitive with our approach to the estimation of program or treatment effects. The more we explore the micro effects, the more we will be able to explain individual behavior in a manner consistent with economic theory and its assumptions about human behavior. A model based on individual utility maximization should allow better measurement of program impacts on various clients.

(Refinements of the basic benefit cost model are presented in chapters 10 through 14 where real data are used to measure such things as effectiveness of services and the clients' functioning or what might loosely be called, health status. These are our first empirical attempts to estimate aspects of this model).

Part II

BENEFIT COST ANALYSIS USING R-300 DATA

The R-300 Data Set

As pointed out above, the rehabilitation program has pioneered in the production of real, useful information about what has been going on in the program and what results have been achieved. The program has suffered s bit from being the first on the block, as it were, but useful data are published about the program each year. The question before us is whether these data are sufficient for benefit cost analysis.

We will call the data set, the R-300 data, although it has undergone several name changes in recent years as it has become involved in controversies about what should be collected and transmitted by the states to the federal government. Each year, a report is made on all cases closed in each of the state agencies, whether the case is closed out successfully, i.e. "rehabilitated" or in one of the several nonsuccessful closure statuses. For each case, information is presented on such items as demographic characteristics, services received, wages at opening and wages at time of closure. Each of the variables is discussed in chapter 5.

A Simple Benefit Cost Ratio

We have already observed that a benefit cost ratio based on a simple comparison of wages at acceptance and wages at closure does not make much sense. Nonetheless, this is the method that has tradtionally been used and we begin our explorations by replicating this method in Chapter 6. We compute the ratio using the simplest of methods for both the universe and a 1% sample.

We can summarize the salient aspects of this method:

1. Wages at referral are used as reported. (No adjustments are made for persons reporting zero wages.)

2. The average wage at referral are subtracted from the average wage at closing and the difference is attributed to the program.

3. That wage difference is assumed to continue into the future for 30 years. No adjustments are made for productivity or inflation. The present value of these benefits are calculated using a 12% rate of discount.

4. Costs are estimated using reported case service costs and adjusting these to take into account administrative and other fixed costs.

We know this is a crude method. Our work reported in Part II is dedicated to discovering whether applying other statistical or econometric methods can help improve this basic method.

Stratification by Cohorts

One method of attack is to stratify clients by cohorts according to age, sex, race, education and disabling condition. Such a method helps answer some of the questions often asked about the program. How does the program do in rehabilitating persons with mental impairments as opposed to those with physical ailments? Since it is obvious that education and age also effect outcomes, in chapter 7, we use multivariate regression techniques to standardize for the effects of these other variables.

In effect, we compute separate benefit cost ratios for each cohort taking into effect the probability of successful closure. In these calculations, we still use the difference between earnings at referral and earnings at closure as our measure of benefits, but use different methods of compounding estimated

earnings gain over the lifetimes of the individuals and different methods of assigning wages to those who report zero wages at referral. Using benefit cost analysis in this fashion obviously has potential for management information purposes. It also blurs the distinction sometimes made between benefit cost analysis and cost effectiveness analysis. Each is these is a measure of efficiency useful for both evaluation and mangement purposes.

Econometric Corrections for Zero Wages at Referral

There has been a good deal of work done by James Heckman at Chicago and others on this general problem. Simply to assume that the wage reported by workers can be used to estimate the potential wages of nonworkers leads to some bias because of the difference between these two groups. In Chapter 8 we apply Heckman's correction to the R-300 data. We know that simply using the reported zero wages is not appropriate but whether the corrections are the solution is not obvious. For one thing, they lead to much higher estimates of wages for those who report zero wages than for those persons who report positive wages. We may be seeing the disincentive effects experienced by those persons who are out of the labor market and who require a wage higher than the level of their transfers to induce them to work.

Imputing Wages to Person Closed Nonrehabilitated

Somewhat the same techniques used to impute wages to nonworkers can be used to estimate the probable wage of those

who were closed out unsuccessfully. We know that some persons leave the program because they move to another state. Others drop out and the counselor has no idea what happened to them. Yet some of these persons who are classified as failures receive a substantial amount of services and have demographic characteristics similar to the persons who were rehabilitated. The results, presented in Chapter 9, appear reasonable. Earnings estimated for the unsuccessful closure are somewhat lower than for the successful closure but they add significantly to any measure of the program's effectiveness.

Can Anything More be Done with the R-300?

It would be foolish for us to conclude that we have rung all of the changes possible using the national data, but we suspect that we have come to the effective end of the road. Our task was to take the national data and see what could be done with it. We began with the crudest method utilizing the average wage at referral and the average wage at closure. We experimented with compounding these earning gains in various ways. We then broke the data down into cohorts and calculated benefits and costs separately for each cohort in various ways including the calculations of age-earnings profiles for the several cohorts. All of this was done using reported wages (including zero wages) at referral and wages reported at closure for the successful rehabilitants.

As is apparent from an examination of the tables in these chapters, the results are quite sensitive to the assumptions made as to unemployment, rates of inflation, rates of discount, etc. Critics of the method who point this out are quite correct, but most of these problems would be minimal if we had a genuine control group or better longitudinal data. The basic problems relating to the foundations of the analysis would persist regardless of the information base.

Our next set of corrections involved correcting for those who reported zero wages at referral, and, at the other end, those for whom no wages were reported at closure. We certainly have not exhausted all of the combinations and permutations, but, we suspect that we have done enough. All of the econometric corrections, and all of the manipulations of the existing data still fall short of our goal. None of these corrections we have done, nor any we can think of, result in a benefit cost ratio in which we can have confidence. We would be delighted if someone would come along and apply some different method to these data and prove us wrong.

Part III

ACTIVITY AT THE STATE LEVEL

Benefit Cost Activity at the State Level

States have been quite active in conducting benefit cost analyses at the state level although interest and ferment in this area seems to have quieted in the last several years. In Chapter 10, some of the results of this activity are reviewed. For the most part, the states use one variant or another of the basic model developed by Berkeley Planning Associates. Essentially, it recognizes all of the problems detailed in Part II. It attempts to solve them by applying information derived from separate studies to correct for everything from zero earnings at referral to permanence of reported earnings at closure.

Apparently, there has not been a great deal of activity on the benefit cost front in the last several years. The newest models are derivatives of the older models with variations based upon some newer corrections. Some of this inactivity is traced to changes in evaluation emphasis at the federal level.

More Data at the State Level

The states have resisted collecting more data to transmit to the federal government. Yet, for their own management information purposes, state agencies do collect a good deal more information than they transmit to the federal government on the

R-300 form. In Chapter 11, we examine the results of a survey designed to show what kinds of data are routinely and normally collected at the state level.

We reach one conclusion. While it may not be possible to compile an augmented data base at the national level, it should be possible to use data now being collected at the state level for benefit cost purposes. As shown in this chapter, some (much) of these data are not now being used for this purpose, and what may be worse, some of it is not being collected in an easy retrievable form so that it can be used for this purpose in the future. Strong leadership at the national level, suggesting but not compelling, collection of these data and demonstration of their uses might accomplish a great deal.

PART IV

USING AUGMENTED STATE DATA BASES

Using Better Measures of Services

Chapter 12 is an example of what we think can be done using existing state data. Surely, it is not enough to think about the benefits of "rehabilitation" as if it were some uniform process, the same for each person who comes to the program. The glory and the genius of the vocational rehabilitation program has been its ability to bring to bear a wide variety of services from physical restoration to retraining to solve an individual's

problems. As we stated in our basic model of the program (Chapter 4) it is possible to think about the duration, intensity and type of services offered in the program.

Each state program has to devise some method of paying for services it purchases, and many states have computerized their payment methods. In this chapter, we have relied, not on counselor records from the R-300, but on payment vouchers, to measure the services provided to a client. We also present some preliminary information as to the costs of counselor time and the cost of similar benefits provided outside the VR program. We have a long way to go but are confident that we are on the right track. States have some of this information in their possession. It is data they collect for fiscal and management purposes and that very same data can be used to help us understand and evaluate the functioning of the program.

Using Better Measures of Disability Status

All of the micro analysis of state program data depends crucially on some measure of disability status. Condition classification codes are too general and fail to take severity into account. In Chapter 13, we present some results using the Functional Assessment Inventory (FAI) measures. The FAI may not be the measure that we eventually will use, but the analytical methods should serve for a variety of measures. We would like to use the FAI, not only as an independent standardizing variable,

but as a dependent or outcome variable, although we are aware of the difficulties noted above (Chapter 4) of trying to aggregate health statuses across individuals.

Establishing a Mini-Data Link

Linking RSA and Social Security earnings data is an obvious way to compile earnings information for rehabilitation clients and we explore its possibilities in our conclusions. In the course of doing this report, we found that it was possible to establish mini-data links at the state level using the state vocational rehabilitation program data and earnings information available from the state employment insurance offices. In Chapter 14, we present the first results of linking an augmented R-300 data bases for one year in one state with these earnings records. We are encouraged by the results and look forward to trying to forge links between reported earnings at referral and these actual records.

Having these earnings records available allows us to estimate the models described in Chapters 3 and 4. Given the actual data, the corrections for zero earnings discussed in Chapter 8 and the corrections for earnings of those closed nonrehabilitated (Chapter 9) can be applied more realistically. No data link will ever match all records, but the number of missing observations shoud be relatively few and more amenable to econometric correction.

In general, we leave our examination of activity at the state level with a great deal more optimism and hope than we did when we looked at what was being collected at the national level. States are collecting, for their own purposes, a lot of useful data, albeit not in the form or for the purposes we have in mind. We have shown that a good deal can be done with better information on services and measures of disability status. We are left with the impression that a lot of energy and work could be brought to bear on this problem if appropriate signals were given at the federal level.

CONCLUSIONS

What we have learned is summarized in Chapter 15. One of the lessons we failed to learn was how to write a short report. We apologize for its length, but we have explored many alternative methods of benefit cost analysis in vocational rehabilitation. We have tried to present our results in sufficient depth and with sufficient explanation so that this same work need not be done again in the near future. One of our recurrent nightmares is that even as we finish this report someone, somewhere, is answering an RFP which calls for a review of the literature, or an investigation of the theory which lies behind benefit cost analysis of the vocational rehabilitation program.

We believe we have carried the analysis of the R-300 data for benefit cost purposes about as far as it can go. And we

conclude that even going that distance is not enough. Where should we go from here?

There are exciting possibilities at the state level using mini-data links and we suggest possible models and ways and means of devising control groups. The federal role might be to encourage demonstrations along these lines. The demonstrations would serve, not only for benefit cost purposes, but to aid administrators in management and counselors in individual case handling.

Our preferred alternative is for a genuine control group experiment at the federal level. We believe that the ethical issues involved can be resolved with the use of vouchers. No applicant need be denied services, but alternative methods of delivery of these services would provide the basis for the evaluation. We suggest use of the models and methods for accounting for services, standardizing for health status, etc. which we have explored in this report.

Our second best alternative involves the forging of the SSA-RSA data link and using individual data so that some multivariate analysis could be done at the individual level. The matter of a comparison group would present some problems but these might be solved, either along the lines of one of the models suggested in Chapter 3, or by using some other comparison group.

Spending countless months with the data from the vocational

rehabilitation program leaves one with a rich appreciation of the work being done. No other program has its mission of returning hundreds of thousands of impaired persons to a productive work life. It was the first program to demonstrate its effectiveness. Having lagged in recent years as other programs moved forward in this area, perhaps, the time has come, once again, for it to demonstrate its leadership role.

Chapter 1

THE COST-BENEFIT TRADITION IN VOCATIONAL REHABILITATION

Edward Berkowitz*

> Senator Chavez: What happens to rehabilitated personnel once you get them rehabilitated and, for instance, you place them in industry?
> Miss Switzer: We put them to work.
> Senator Chavez: Do they stay?
> Miss Switzer: They stay at work. We have some pretty good material on that. They not not only stay at work, but they get good wages, and they pay good income taxes.
> Senator Chavez: If you have some figures on that which you can place in the record it would be a good idea, because, you know, a lot of people do not understand just exactly what you are trying to do.(1)

On January 12, 1966, the Secretary of Health, Education, and Welfare announced the establishment of the office of the Assistant Secretary for Program Coordination. This new office sought to examine the many programs administered by the largest federal department concerned with domestic affairs. Among other tasks, it hoped to institute a Planning-Programming-Budgeting System. A product of the McNamara era, PPBS was intended to help the various programs match their objectives with their expenditures. At the same time as the new office initiated PPBS, it also launched cost -benefit studies of the programs, to determine which programs produced the most return for each dollar expended on them.

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Washington. D. C.

In response to the Secretary's memo, statisticians in HEW set out to do a cost -benefit study of the vocational rehabilitation program. Unlike the other programs, vocational rehabilitation already had a long tradition of this sort of analysis, one that had helped to sustain it from its origins in the 1920s to the 1960s. In the past cost-benefit analysis had demonstrated the worth of the program; now, cost-benefit analysis would serve a new purpose, that of comparing the program to other programs. HEW was confident that the program would meet the new test. They expected their study to "dramatically reveal the impressive gains to be derived from this program."[2]

The statisticians knew of the pitfalls involved in cost-benefit analysis. In an ideal sense, the analysis should compare all costs to all benefits of the program, but some of these costs and benefits eluded the analyst. Either they could not be properly quantified or they could not even be properly identified. In particular, the HEW statisticians, who arrived at a lusty benefit-to-cost ratio of thirty-five to one,lamented the lack of data on what happened to rehabilitated people after their rehabilitation. How many of them died, retired, or experienced new impairments? The program records maintained a relative

silence on these questions.[3]

This silence was understandable. The program did not exist for the convenience of the policy analyst. In fact, cost-benefit analysis had always been used as a simple demonstration that the program represented a net benefit to society. This demonstration helped to distinguish the program from other social welfare programs that simply transferred money from taxpayers to the poor. The demonstration had never been intended to serve as an explicit tool of policy analysis that would govern the total level of program expenditures and set priorities within the program. Those uses of cost-benefit analysis came much later, arriving only in the middle sixties.

The program itself functioned in a way not likely to generate useful data for cost-benefit analysis. A handicapped person went to a succession of interviews with a counselor. Together they worked out a course of action to overcome the person's disability. The process resembled any training exercise: it was relatively short and had a definite beginning and end. After the program was completed, a rehabilitated person had no more reason to remain in touch with his counselor than a high school graduate did with his teacher. True, many rehabilitants stayed in touch, just as the high school endeavored to keep in touch with its alumni, particularly those alumni who had achieved success. Many rehabilitants, however, simply dropped out of sight, their new lives totally separate from their earlier

existence. As a consequence, it became difficult to follow the course of their careers, difficult to perform cost-benefit analysis.

Program officials worked with what what they had available. Since it was impossible to specify and measure all of the program's benefits and costs at any given moment, program officials emphasized the most obvious and important of those benefits and costs.

A study of cost-benefit analysis in the vocational rehabilitation program over time, therefore, reveals contemporary perceptions of the program's purpose and methods. It also shows how various customs in data gathering and analysis became established. As the program entered the modern era, these customs played a large role in determining the sort of cost-benefit analysis that modern statisticians could perform. They also tended to set the standards by which modern analysis would be judged. If the old customs generated impressive results, then modern methods tended to be accepted only to the extent that they produced similarly favorable results. In the program's traditions, therefore, lies the core of support and opposition to modern cost-benefit analysis.

Arrival of Cost-Benefit Analysis in the Twenties

Unlike other social welfare programs, vocational rehabilitation began as an economic proposition. During the late

progressive era and early twenties, nearly all new social welfare programs--from widows' pensions for mothers with dependent children, to retirement programs for the elderly, to infant and maternal health programs-- received support on the basis of their value to society. Most of these programs, however, primarily involved the maintenance of people who had come to depend on the government's support. The proponents of vocational rehabilitation, by way of contrast, saw their program more as a cure for disability than as a means of supporting it. Instead of increasing government expenditures, therefore, vocational rehabilitation promised to reduce them. "Curing the disability is far and away the more economic procedure," said the federal agency in charge of the new program, "and in this case sound economics is clearly sound public policy."[4]

Vocational rehabilitation, as an outgrowth of workers' compensation, benefited from the era's interest in the concept of efficiency. Workers' compensation became the most ubiquitous social insurance program during the progressive era in part because it could be defended as a sound business investment. By forcing an employer to pay the costs of the disability he created, workers' compensation helped to reduce industrial accidents and, in this manner, promoted the goal of efficiency. Once an accident occurred, however, workers' compensation could do little beyond maintaining the injured workman. Vocational rehabilitation carried the efficient approach to industrial

disability one step further by restoring the injured workman to a condition of productivity.[5]

Whatever the reasons, program officials attached the rhetoric of efficiency to the program almost from its very beginnings. As early as 1922, program officials could describe vocational rehabilitation as part of the societal effort to "attain the highest possible degree of national and personal efficiency." In fact, vocational rehabilitation formed the human counterpart of the national drive to conserve national resources. After all, proclaimed the program officials, "our only real wealth...is human effort."[6]

One benefit of efficiency was that it could be described in numerical terms. "Efficiency," said the federal officials, "is the fullest possible utilization with the least expenditure of time, resources and powers to effect a desired result." Such rhetoric suggested that vocational rehabilitation would pay dividends, although program officials adopted an initially cautious approach. They said that vocational rehabilitation, like education, would "pay well" but warned that the "profit can not in either case be accurately delivered in dollars."[7]

By 1926 all reticence had been dropped. It was only natural, according to program officials, "to raise the question whether the investment of federal and state funds in the civilian vocational rehabilitation program brings adequate return." Having

raised the question, program officials proceeded to answer it. Their answer marked a very casual form of cost-benefit analysis.[8]

The terms of this analysis remained with the program for decades. It began with the observation that the average weekly wages for all persons rehabilitated in the United States during 1924 was $26.07. These people would, on the average, enjoy a life expectancy of at least twenty years. It followed that they would earn an impressive $147,004,000 during those years, an extraordinary number when compared to the slightly more than one million dollars that it took to rehabilitate them.[9]

Such findings encouraged program officials to probe further into cost-benefit analysis. The limitations of the earliest work were obvious even to contemporary observers. Instead of following the rehabilitants through their working lives, the analysis simply assumed that they would remain employed at their present jobs until death or retirement. Moreover, the analysis failed to look into the earnings of the rehabilitants before they entered the program. Although limited by the program's short life, program officials made an attempt to correct these deficiencies with a major study of people rehabilitated between 1920 and 1924 who were followed up in the year 1927. Tracy Copp, one of the ablest federal workers employed by the program, conducted the study and wrote the final report. Even as the study was being conducted, program officials, such as John Kratz who supervised the federal office, felt confident that "this study will

ultimately demonstrate scientifically and beyond question that the vocational rehabilitation in the States is permanently economically sound and socially worthwhile."[10]

The hopes of the federal officials also revealed their anxieties. Cost-benefit analysis offered the means of solving two of the program's problems. As an experimental program, vocational rehabilitation faced the constant threat of extinction. In the twenties, unlike later eras, federal social welfare programs sometimes went out of existence; Congress simply refused to reappropriate funds. Throughout the twenties, the program's very existence was precarious, with Congress often delaying the appropriation of funds. Not until the passage of the Social Security Act in 1935 would the program become permanent. Cost-benefit analysis, therefore, provided advocates with ammunition to use to sell the program to Congress.

Not only did the analysis strengthen the program's case with Congress, but it also solidified the role of the federal employees who supervised the program. These federal officials, after all, did no casework; they were not involved in rehabilitating the handicapped. The role of the federal office in a program that operated on the principle of grants-in-aid to the states was just being invented. By undertaking cost-benefit analysis, federal officials were doing work that helped to boost the program, work that could not be done as effectively by the

states themselves.

These facts helped override any lingering doubts about the propriety of applying economic analysis to a social endeavor. In the 1927 annual report, the program officials included a long discussion of this matter. They distinguished between people who viewed the program as an operation in "social salvage" and those who saw it as engaged in "economic salvage." The former group believed the benefits of the program lay in the way in the way it relieved the handicapped of their anxieties and their natural feelings of inferiority. The latter group thought that the program's strength centered on the way it restored the handicapped to "self-supporting ability." The federal officials entertained no doubts on this matter. They identified with the economic point of view because it enabled them to apply the concept of efficiency to the program. "During the last year," wrote the program officials, "there has been a very marked increase ...in the acceptance of the economic point of view with a corresponding readiness to consider problems of securing the greatest social return for a dollar expended."[11]

Despite the boldness of this statement, the federal officials felt an ambivalence that would continue to characterize the program. On the one hand, vocational rehabilitation represented an important entitlement, an obligation on the part of society regardless of whether or not the handicapped repaid the investment made in them. On the other hand, the program did pay

for itself and that feature made it all the more attractive. "Vocational rehabilitation is an investment in human welfare that is wholly self-liquidating," argued program officials in 1953, even as they stressed that the program deserved support because of the "American tradition of a fair chance for all." There was then a duality about vocational rehabilitation. It fell under the domain of society's charitable activities and yet it could also be justified in more pragmatic terms, as a convenient undertaking that made economic sense. Depending on the economic conditions, the program could take on a protective coloration to suit the times.[12]

Intermezzo: The Thirties and Forties

The thirties represented a supreme test of the program's adaptability. This depression decade changed the American style of social welfare decisively. Efficiency motives took second place to a more straight-forward mode of social welfare that had the virtue of getting money, not training or other services, into people's hands quickly. At the same time, the earlier styles of social welfare did not disappear. Instead, the major social welfare laws of thirties, such as the Social Security Act of 1935 and the Fair Labor Standards Act of 1938, tended to strengthen older programs even as they introduced new ones. Despite this acceptance of older programs by newer ones, the older programs, particularly those that depended on the now much-weakened private

labor market, could not easily survive in the thirties.[13]

If cost-benefit analysis proved to be an important asset for those who defended the validity of vocational rehabilitation, it also underwent many tests during the thirties. Program officials maintained a general silence on the results of cost-benefit studies in the thirties. In 1931, however, there appeared a revealing follow-up to the studies conducted earlier. The officials made no attempt to cover up the effects that the depression had on the program. For example, the group of a thousand people studied had no earnings before rehabilitation in 69 percent of the cases, and immediately after rehabilitation 73 percent earned over fifteen dollarsa week. In the years intervening between their rehabilitation and 1927 (the group had been rehabilitated between 1920 and 1924), the percentage earning fifteen a week had risen to 80 percent. In 1931, by way of contrast, this percentage had slipped to 61 percent. Program officials believed that the hourly wages of most rehabilitants remained the same, but the depression had forced them to reduce the number of hours they worked.[14]

When viewed on a more aggregate level, the numbers illustrated the effects of the depression even more clearly. The state and the federal government invested $291,000 in the rehabilitation of the thousand cases. Their earning capacity before rehabilitation amounted only to $332,132. Immediately after rehabilitation, this capacity rose to $1,035,780 per year; by 1927, the capacity

reached a high of $1,243,301 per year, and by 1931 it had slipped to $929,702 per year.[15]

In modern times, such results might have called the entire exercise into question. The first cost-benefit studies had, in effect, posited no unemployment for the people rehabilitated and no cuts in the level of wages. The 1931 follow-up showed the vulnerability of rehabilitants to macroeconomic forces and made it quite plain that an economic downturn would reduce the benefits that accrued to rehabilitation. Such reasoning did not occur to contemporary observers. They were not attempting to fine-tune the terms of licy analysis. Instead, they were demonstrating a simple point: rehabilitation paid dividends. Like any financial venture, the dividends varied from year to year to reflect business conditions. The important point, however, was that the program continued to pay its dividends; that fact alone made the program worthy of remaining in business. In fact, program officials decided not to follow up the group beyond 1931. "No attempt is made to predict the period of years they will continue to be productive," wrote the program officials. After all, the rehabilitants had already proven their worth to society. "All future production of these persons will represent so much additional return upon the original investment."[16]

Even when economic conditions improved in the forties, program officials launched no major new cost-benefit studies.

Despite the passage of a major new rehabilitation law in 1943, program officials showed little inclination to refine the terms of cost-benefit analysis. The new law in 1943, which permitted the states to pay for the physical restoration of clients with federal money, had as much to do with the exigencies of war and veterans' politics as it did with the use of cost-benefit analysis as a policy tool.[17]

Cost-benefit analysis became something of an afterthought in discussions of vocational rehabilitation. It was not represented as an important part of a continuing process of evaluation; rather, it received mention from year to year as an incidental demonstration of the program's value to society. The presentation for 1943 was typical of those throughout most of the decade. The program managed to rehabilitate forty-two thousand people in that year. Eighty-five percent of those people were not working just prior to rehabilitation; in fact, 31 percent had never worked before. These 31 percent represented a segment of the population that decided to enter the labor force as a result of the expanded labor market nurtured by the war. The remaining 15 percent of the rehabilitated population had worked before rehabilitation but at very marginal jobs that paid low wages. Even including welfare payments from sources like the rapidly fading Works Progress Administration (WPA), the average pre-rehabilitation wage for the group was eighteen dollars per week. Those conditions permitted a very broad comparison between the

program's costs and its benefits. In the 1943 case, the program expenditures increased the group's earnings from $ 5,913,648 before rehabilitation to $65,165,828 just after. This demonstration ended the discussion, leaving people to wonder what element of the program had been responsible for these impressive returns. This year, as in the years before, the statistics tested nothing. Instead they showed that a good deed also paid.[18]

Even as the war expanded opportunities for rehabilitation, many questions remained. In 1944, with the economy booming, the states maintained a register of 269,960 handicapped people. Only 145,059 of these people received services. As many as 61,565 people were investigated but not served any further. The reasons were reported in the most vague and general of terms. Some of the people--how many people was not reported- refused to accept the services. In other cases, the services were not needed, perhaps because the wartime economy demanded little of its labor force participants beyond a willingness to work. In still other cases, the agency found the person not sufficiently cooperative to make rehabilitation possible. Clearly, these investigations that led no further represented costs to the agency that yielded few benefits. The agency never pursued the matter. It did not believe its obligation extended to discovering all of the program's costs and benefits. A clear declaration of the program's value, buttressed by a statistical demonstration, remained enough.[19]

In the forties, these demonstrations had a curiously static quality. No one made an effort to compare the results from one year to the results from another year. Had someone bothered to do so, he would have discovered that the statistics indicated a declining benefit-to-cost ratio from year to year. Since the ratio remained well above one, it did not matter. Each year the agency performed the same calculation with different numbers, and each year it came up with a glowing report on the program. Using the now standard methodology of comparing earnings before and after rehabilitation, the program officials came up with a twelve-fold increase in 1944, a six- fold increase in 1945, and a four-fold increase in 1946.[20]

Was the program expanding to take advantage of the disparity between marginal benefits and costs? On the contrary, the program was languishing. The pioneering generation of program administrators had been replaced by a benign but unenergetic group of federal employees. The number of rehabilitations fell from 44,000 in 1944, to 41,925 in 1945, to 36,106 in 1946. By 1946 the cost-benefit demonstration had become so half-hearted that the agency simply extrapolated data from less than half of the rehabilitants to the entire group.[21]

The next year, 1947, marked a transition between the pride and optimism of the twenties and the apex of the cost-benefit tradition in the fifties. For the first time in many years, an agency dressed up the rhetoric it used in its annual report. A

sharp increase in the number of people rehabilitated accompanied the new rhetoric. The changed rhetoric suggested a new awareness of the way in which rehabilitation linked with other societal efforts. The difference between the amount expended on rehabilitation and the amount that the rehabilitants earned now represented "an increase of about $54,000,000 in the annual earned income of the nation." Not only a sense of national income accounting but also a new conception of the benefits of vocational rehabilitation appeared in the report. Rehabilitation transformed people from recipients of public funds into taxpayers. In only a short time, the cost of rehabilitation would return to the federal and state governments in the form of taxes paid by the rehabilitants. Something new had arrived on the rehabilitation scene.[22]

Ten to One: The Ultimate Demonstration

The 1948 Annual Report of the Federal Security Agency, the home agency of the vocational rehabilitation program since 1939 and the forerunner of what would become the Department of Health, Education, and Welfare in 1953, included its usual report on vocational rehabilitation. One of the staples of such reports was the case history that showed the program to best advantage. In this year, the agency featured the story of a young hemiplegic who also suffered from what the agency called defective vision. Only sixteen years old, the boy faced a

lifetime of expensive inactivity or, with the right sort of help, an entire career of productive employment. The boy dropped out of high school, further diminishing his chances for a successful career. Then the agency discovered him, tested his aptitude, and paid for a course in bookkeeping and typing. Still, it was not enough to liberate the boy from dependence on others. His attitude remained poor; he demonstrated "personal maladjustment" and "emotional instability." The answer to this problem was psychotherapy, and by virtue of the 1943 law, the agency managed to get him this help. Now the newly well- adjusted boy went out and got a job, earning $75 a week as a demonstrator of home furnishings.[23]

If the emphasis on psychiatry was new, the example was very old. Putting the rehabilitation into uplifting human terms had always been the personal counterpoint to the statistical cost-benefit demonstrations. This year, however, the agency pushed the cost-benefit demonstrations into a new realm. It emphasized that the formerly disabled hemiplegic would now pay income taxes. It was almost as if those taxes served as a form of repayment for the advice, the training courses, and the psychotherapy the boy had received from the government.

The 1948 report contained the boldest statements the program officials had ever ventured to make. In the long run, the vocational rehabilitation program cost the federal government "nothing." Instead, it returned "pyramiding profits in what well

may be termed an investment in human welfare." After all, the boy, like many of his fellow rehabilitants, was quite young. The average age of rehabilitants in 1948 was only 31 years. That left 34 more years until the age that the Social Security Act had established as the new standard for retirement. If one assumed that the person worked 85% of that time, "he may be expected to return, in federal income taxes alone, approximately $10 for every dollar the federal government expends upon his rehabilitation."[24]

This ten to one figure soon became the new cost-benefit standard. It possessed an innate simplicity and elegance and argued in very powerful terms for the continued expansion of the vocational rehabilitation program. Like the previous efforts at cost-benefit analysis, the new figure represented the outcome of a demonstration rather than of a careful analytic process. For all of that, its appeal proved to be irresistable.

What assumptions underlay the demonstration? In reality, the agency did not know how much a person made in the year after his rehabilitation. All the agency had were weekly earnings figures for the period immediately after rehabilitation. To obtain a yearly figure, it multiplied this weekly figure by fifty weeks. Then it made the fundamental assumption that a person would work 85% of the time until retirement age. Such assumptions might have overstated the level of earnings the group would obtain. A severe

depression, for example, would make it difficult for the group to be working 85% of the time. On the other hand, the demonstration almost definitely understated the amount of federal income tax the group would pay. The agency assumed that the level of income tax payments would not be increased, that earnings would not rise, and that the group would not have more children after being rehabilitated. Still other factors affected the calculation but in no clear direction. Earnings for farmers and housewives, for example, were not included in the calculation. All in all, the assumptions behind the calculations underscored the delicate nature of the calculation.[25]

Beyond these technical matters, the new cost-benefit demonstration owed its existence to changes in American public policy. The second world war sharply escalated the level of federal spending. Postwar spending levels, although lower than wartime levels, never returned to the low levels of the thirties. Increased spending tended to solidify an innovation in public finance that the war had brought about: the institution of withholding federal income taxes from a worker's paycheck. The forced payment of income taxes during each pay period made the federal income tax much less of an abstraction and much more of a reality. To say that a social welfare program saved federal tax money suddenly meant something.[26]

Another postwar innovation also accounted for the appearance of this new demonstration. In reporting the ten-to-one figure to

the state rehabilitation offices, Joseph Hunt, the federal official in charge of such matters in 1948, reported in passing that the calculation had been performed for the benefit of Congressional committees and of the Council of Economic Advisors. This last group had been created only in 1946 as part of a more general societal interest in economic planning that had produced the Employment Act of 1946. The 1946 act owed its existence to a fear that the prosperity of the war would yield to the grim conditions that had characterized the thirties. Many people believed that the federal goverment could act as a sort of catalyst for the economy and, by initiating the right sort of macroeconomic measures such as public works, maintain the level of employment. The completed act stopped well short of the desires of committed planners, yet it established the Council of Economic Advisors, a new component of the President's bureaucracy to keep him informed of economic trends. The Council became a new consumer of economic information. The vocational rehabilitation program kept this new consumer supplied with upbeat reports on the program's accomplishments.[27]

Whatever the motivation for the construction of the 10-to-one figure, it played well in Congress, where it mattered. Well into the sixties, Congress retained its tight hold over program appropriations, free from pressure to meet spending targets. It fell to program administrators to appear before the appropriation

committees and make the best possible case for the program. In the case of vocational rehabilitation, prospects brightened in 1950 when Mary Switzer took over as director of the program. Bright, energetic and supremely motivated, Switzer made the most of the cost-benefit demonstrations. Unlike her predecessor Michael Shortley, Switzer came from the branch of the bureaucracy concerned with such matters as education and public health. The rhetoric of investment suited her, and in her capable hands it became a staple of Congressional testimony. In this way, it helped to raise the level of program appropriations and expenditures.[28]

Although Switzer might not have invented the ten-to-one figure, she utilized it to its fullest. Early in 1955, for example, she appeared before her friend Congressman John Fogarty and recited the program's virtues. Aware that the initiative for increased appropriations had to come from the Congressman rather than from her, Switzer planted a question. "How much will the Federal Government get in return for every Federal dollar that we spend in rehabilitation?" asked Fogarty. Without hesitation Switzer announced that she had the figures available. "Yes, we have that figure, and it stands up too," she said. "You ought to get back over a period of time, $10 for 1 in Federal income taxes, if our estimates are right. That's what we say."

Fogarty hastened to put the matter into even less abstract terms. He asked how much the government could expect to receive

from an investment of $39 million dollars, and Mary Switzer reassured him that the government could ultimately expect $390 million dollars.[29]

In the Congressional setting, no one bothered to correct Mary Switzer's economics. No one made mention of concepts such as the present value of $390 million dollars and questioned whether it was worth more or less than the $39 million dollars Congress would appropriate <u>now</u>. At the same time, Congress often challenged the figure, only to be reassured of its validity by Mary Switzer. "Everyone," she said, "is skeptical of this statement at first." To check the figure, she reported, the agency had met with the Treasury, and the figures held up. Looking for a reason to appropriate money to the program, Congressmen seldom pursued the matter. Such subjects as the proper bureaucratic location for the program animated them far more than did the terms of cost-benefit analysis. On occasion, however, a Congressman stumbled upon a potential weakness of the analysis. Senator Dennis Chavez of New Mexico once asked Mary Switzer if the program followed up the rehabilitants. "Suppose they only worked for 1 day?" the Senator asked. "We follow them up," said Mary Switzer. "We have found over the years that the total group statistically works on the average of 85% of the time, which is pretty good." Indeed, it was good, yet it rested on the thinnest of evidence. The appeal of rhetoric overcame

doubts based on methodology or evidence. If something increased appropriations, then it worked, and the ten-to-one figure worked.[30]

In the early fifties, the program literature made almost constant reference to income taxes spent and saved. In 1953, for example, the program announced that "rehabilitation is more than an expenditure per se; it is an investment which produces tangible dollar returns, along with the human rewards." There followed an analysis of what had happened to the 60,000 people who had been rehabilitated in 1952. Their earnings had increased from 17 million to 115 million. This group, it turned out, would pay 9 million dollars in federal income taxes in the first year after their rehabilitation. Over the course of the next three years, they would completely pay for their rehabilitation, and over the course of their lives they would return 10 dollars in federal income taxes for every federal dollar spent on them. The President's Committee on Employment of the Handicapped aggregated the numbers across the years. In the years between 1943 and 1955, 642,000 people were rehabilitated. As a result, they increased the national income by more than three billion dollars and paid more than 300 million dollars in federal income taxes. Indeed, they had already paid for both the state and federal costs of the program. It made for a wonderfully felicitious calculus.[31]

Another Benefit: Ending Dependence

Although wonderful in itself, the ten-to-one demonstration

brought further benefits to the program when used in conjunction with another argument. As program advocates had always maintained, vocational rehabilitation transformed individuals from a condition of dependence to one of self-support. The rehabilitants started as a net cost to society and ended as a net benefit. In the program's early years, the costs of dependency remained sketchy, as one might expect in a social welfare system that spread its programs between the public and private sectors and among the states, localities, and federal government. After the second world war, however, these costs took the much more explicit shape of the federal-state public assistance program. Created in 1935, the public assistance program generated little controversy during the depression. After the war, however, people perceived a threatening paradox: welfare costs continued to rise, even when the unemployment rate fell. The costs of dependency, as defined by the welfare program, became both more visible and more menacing.[32]

Such conditions suggested a natural comparison between the vocational rehabilitation approach, with its promise of returning 10 dollars for every dollar spent, and the public assistance approach, with its continual debilitating demands on the public purse. Not only did the vocational rehabilitation program cost nothing, it also ended dependency. In the late forties and fifties, this latter feature became all the more appealing and

received more frequent play from program officials.

Events served to strengthen this new item on the benefit side of the cost-benefit equation. The original federally assisted welfare categories included the blind, the elderly, and dependent children. In 1950, just when the ten-to-one figures began frequently to appear, Congress added a new category to pay welfare to the permanently and totally disabled. This action came in the middle of a protracted debate over the advisability of adding disability protection to the social security system, a debate that extended into the Korean War years. During those years, people questioned the need for handicapped people to be dependent on others when they could make obvious contributions to the war efforts. Each of these things tended to make the problem of dependency more visible than previously.[33]

The subject of dependency caused Mary Switzer to wax philosophical. She often called rehabilitation "a philosophy of life," and she looked for trends that helped put social welfare policy into perspective. In 1953 she identified one such trend and put it into the form of a question before Congress. "Why do we have such a heavy relief load in most places in a period of high employment?" Part of the answer, Switzer believed, lay in the fact that "a very large percentage of this welfare load of ours is due to neglected physical disability." True to the hard-headed tradition of humanitarianism in vocational rehabilitation, Switzer attached numbers to the statement. Counting the various

programs, she arrived at a figure of 400 million a year to reflect the welfare-related costs of disability. That figure met only the very barest of needs.[34]

Rehabilitation, it need hardly be added, was not a welfare program. It put people people into jobs, rather than keeping them away from jobs. "That is the basis of it," said Mary Switzer.[35]

There followed increasingly elaborate estimates of the cost of public assistance matched with the now-standard estimates of the returns to vocational rehabilitation. In 1952, for example, the bill for public assistance came to $395 million, with Aid to Families of Dependent Children consuming the lion's share. ADC payments created two sorts of burdens. They affected the physically disabled parent, and they spread their influence to the next generation of children who would grow up in a household marred by dependency. Children symbolized potential, and public assistance blighted that potential. The average payment for ADC amounted to $863 per family. Such expenses could continue for several years, possibly through the entire childhoods of an entire family. Rehabilitation, it need hardly be added, represented a one-time expenditure. "These facts are the simple arithmetic of rehabilitation," the federal office for vocational rehabilitation reported in 1952. "They are the hard dollar-and-cents realities which establish the ...program on a sound economic basis."[36]

On the state level, the process by which vocational rehabilitation saved money could be followed with special clarity. Apocalyptic rhetoric--on the order of, "In the face of the Nation's many requirements to maintain adequate military power, to exert influential leadership toward world peace, and to meet domestic needs, it becomes imperative that we examine all costs which in any way interfere with our capacity to fulfill these responsibilities."--carried the program only so far. It worked much better to detail the program's accomplishments in a state such as Pennsylvania, which in the fifties maintained one of the nation's best vocational rehabilitation programs. In 1952 the Commonwealth of Pennsylvania rehabilitated 3,352 people. Of that number, 695 people had been on public assistance. That meant they received $762,684 annually in public assistance Vocational rehabilitation ended that burden and substituted $1,406,912 for the previously negative earnings. As the state reported, "they were tax consumers through no fault of their own. Now they are taxpayers in their own right..."[37]

It remained to determine the number of people who became rehabilitated from the public assistance rolls on a national basis, and by 1954 the program literature began to include that information. For fiscal 1953, one out of 5 disabled persons rehabilitated during the year was receiving public assistance at the time services were begun.[38]

Always sympathetic to the jargon of psychology, program

officials painted the conditions of dependency in the darkest of terms. At the very least, dependency meant a loss of financial independence. In reality it led to far more serious problems. The individual on public assistance faced damaged morale reinforced by an impaired living standard. And what of this individual's family? All too often, such dependency meant "dissolution of the home and destruction of the family." The Office of Vocational Rehabilitation developed an elaborate illustration in 1953. At first, the diagnosis reflected "on the personal tragedy in one life." Then a host of by-products materialized, never well understood in relation to one another but all of them related to the disability. The person lost his job, income, and savings. So far, the illustration stayed well within the bounds of economic analysis; then, it branched off into the realm of psychology. "As standards of living go down, emotional stress goes up. Other ills, physical or psychogenic, emerge in the family to complicate the initial disability. Children deprived of the love and guidance of their parents find substitutes elsewhere and society calls it delinquency. When the situation finally overwhelms the group, then welfare and other public agencies must take over the case."[39]

Nor would the problem go away. As the nation became older, it would face more and more problems related to dependency. Science produced wonderful gains, such as increasing the life span of an

individual at birth from 49 to 68 years over the course of the twentieth century, yet it also generated difficult quandries. More older people meant more retired people, more dependent people. The ratio of productive to non-productive workers would decline, and ever larger numbers of aged, chronically ill, and disabled people would have to be supported by those who worked. The taxpayers needed the sort of relief that rehabilitation could provide. They required the sort of technology that enabled people to be lifted from public assistance, workers' compensation, and the other public programs that threatened to grow at alarming rates. They needed to transform those dependents, remove them from institutions and other places of passivity, and transform them into taxpaying workers, allies in the struggle against dependency.[40]

Conclusion

The development of figures on dependency completed the weapons in the vocational rehabilitation armada and defined the terms of cost-benefit analysis until the revival of the Council of Economic Advisors and the beginnings of what might be called an econometric consciousness in the sixties. The cost side of the model remained undeveloped. The costs of the program were measured quite directly by formal program expenditures. The benefit side of the model exhibited a dynamic tendency to grow with the times. At first, benefits consisted of a worker's wages; by the fifties, the benefits grew to encompass the income taxes

paid by the rehabilitants and the welfare costs saved by the rehabilitants.

Modern observers might criticize the model on any number of grounds. To cite one obvious example, the program officials never tried to separate one rehabilitant from another. They assumed that public assistance recipients cost as much to rehabilitate and returned as much in income taxes as did other rehabilitants, yet they never tested that proposition. Working with broad averages, they lacked the technical means to complete the tests.

Before one dismisses the early exercises in cost-benefit analysis as invalid or naive, one needs to bear in mind their real purpose. These analyses did not seek to compare the program to another; instead they sought to provide a rationale for the program that would demonstrate the program's worthwhile nature and win Congressional appropriations. In a more subtle sense, the demonstrations also formed a bridge between the psychologically and individually oriented process of casework and the necessities of public policy. Some programs that relied on casework, such as public assistance, lacked this sort of bridge and suffered in the appropriations process. Vocational rehabilitation grew at a much faster rate than many of its social welfare competitors. Without question, the cost-benefit demonstrations helped.

Perhaps Congressman Roy Wier of Minnesota put the matter best. If the program wanted funds for expansion, he said in 1953, "I

think it will be well if we had some idea of how many, because you have to sell this program,...salvagable people there are, an estimate of the people who are now drawing funds from some sources of the incapacitated condition,....drawing them from society somehow to live. I think that ought to be the place where we substantiate the need for this program."[41]

Congressman Wier understood the exigencies of politics. Although the program continued to be run on the principles of psychological casework at the state level, it benefited at the federal level from the use of economic demonstrations in the form of cost-benefit analysis. The analysis of dependency served to link the economic and psychological analyses to one another.

When statisticians tried to do a more modern form of cost-benefit analysis in 1966, therefore, they stepped into a program with its own set of traditions. On the one hand, program officials welcomed cost-benefit analysis and felt comfortable with it. It had, after all, served to show the program to best advantage. On the other hand, the program had developed its own form of cost-benefit analysis. This form of analysis reflected the policy environment in which the program had developed. The HEW statisticians and their successors would cope with these contrasting aspects of the tradition of cost-benefit analysis in the vocat'onal rehabilitation program.

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32. Edward Berkowitz, Rehabilitation.

33. Idem.

34. Mary Switzer, testimony before Committee on Education and Labor, Hearings Pursuant to Resolution 115, pp. 9, 12.

35. Mary Switzer, testimony before 1952 Senate Appropriations Committee, p. 393.

36. Mary Switzer, testimony before House Committee on Labor and Education, Hearings Pursuant to House Resolution 115, p. 37; Federal Security Agency, Annual Report of the Federal Security Agency, Office of Vocational Rehabilitation, Washington, Government Printing Office, 1952, p. 16.

37. Mary Switzer, testimony before House Committee on Labor and Education, Hearings Pursuant to House Resolution 115, p. 37.

38. Report of the Department of Health, Education, and Welfare, 1953, Washington, Government Printing Office, 1954, p. 230.

39. Ibid., p.229; House Committee on Labor and Education, Hearings Pursuant to House Resolution 115, p. 35.

40. Report of the Department of Health, Education, and Welfare, p. 230.

41. Congressman Roy Weir, Committee on Labor and Education, Hearings Pursuant to House Resolution 115, p. 27.

Chapter 2

WELFARE MEASUREMENT FOR COST-BENEFIT ANALYSIS

Douglas Blair and William Milberg*

Introduction

Cost-benefit analysis finds its theoretical foundation in welfare economics, especially in the branch of welfare economics referred to as the theory of social choice. Social choice, by definition, requires evaluating changes in well-being (welfare) of more than one individual. This chapter will attempt to explore the logic of social choice theory and critically analyze its components. We will first analyze the link between individual and social welfare. Then we will analyze in depth the theories of individual and social welfare measurement. Throughout, our concern will be the link between theory and the practice of cost-benefit analysis.

The chapter will be in three parts. In the first section, we will outline more rigorously the concept of welfare measurement for individuals and groups of individuals. We will see that there are logical difficulties at both levels, indicating the need for caution in using these measures for cost-benefit analysis. We will briefly review the cases, involving strict assumptions, where we may treat the group as one individual.

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In the second section, we will analyze in some depth the problem of measuring welfare and welfare changes for the individual consumer. Specifically, we will compare cardinal and ordinal measures and evaluate their relative usefulness in measuring individual welfare changes. We will then discuss the traditional measure of welfare change, consumer's surplus. We will show some limitations of this measure and define some alternative measures, based on "willingness to pay." We will conclude this section with a review of some recent innovations in individual welfare measurement. These innovations indicate that limitations discussed in the earlier parts of the paper may be surmountable.

The last section treats the problem of aggregating preferences over individuals to measure social welfare. We will conclude by explaining the apparent popularity among cost-benefit analysts of one rule over others, and then pointing out the limitations of this rule. Cost-benefit analysis is the measurement and balancing of the corts and benefits of a public policy in order to compare the policy to alternative policies and to the status quo. The objective of cost-benefit analysis is thus to determine society's ranking of the alternatives. While this paper concentrates on the theoretical problems inherent in cost-benefit analysis, we do not advocate a cessation of its use.

Instead, we hope to emphasize that such analysis requires numerous theoretical assumptions and that cost-benefit analysis is most valuable when these assumptions and their implications are made explicit.

I. The Scope of the Measurement Problem

A cost-benefit analysis of a proposed policy has two parts. The first is to estimate individuals' changes in welfare due to the proposed policy. The second part is to aggregate the estimates for individual agents in order to determine society's ranking of the alternatives.

Assuming we had a satisfactory way of calculating the individuals' welfare (utility) changes, then the most general, individual-based method for aggregation is the social welfare function, introduced by Abram Bergson in 1938, and later by Paul Samuelson [16,27]. The general form of this function is that social welfare (W) is a function of the utility levels of all individuals (U_i, where i=1 to n):

(1) $$W=F(U_1,U_2,\ldots,U_n).$$

To determine the change in social welfare, we take the total differential of the social welfare function:

(2) $$dW = (\partial F/\partial U_1)dU_1+(\partial F/\partial U_2)dU_2+\ldots+(\partial F/\partial U_n)dU_n.$$

In the equation above, the dU_i expressions are the changes in individual welfare described as the first part of cost-benefit analysis. The partial derivatives $\partial F/\partial U_i$ (i=1 to n) can be seen

as weights applied to each individual welfare change. The weights determine, in a sense, how much value society places on each individual's welfare. Depending on these weights, the specific social welfare function could take on vastly different forms. Figure one presents two possible functions. In short, to render the social welfare function operational, the policy maker must specify both the functional form of the social welfare function and the values of the parameters (e.g. weights) of that function.

While it is a normative task to specify individuals' weights in the social welfare function, this specification does not solve all the cost-benefit analyst's problems. We still must measure the individual consumer's welfare changes due to, say, a change in prices. Recall the decomposition of the change in social welfare, equation (2). The dU_i terms are the changes in individuals' utility. This term can itself be dissected, since an individual's direct utility is a function of commodity consumption:

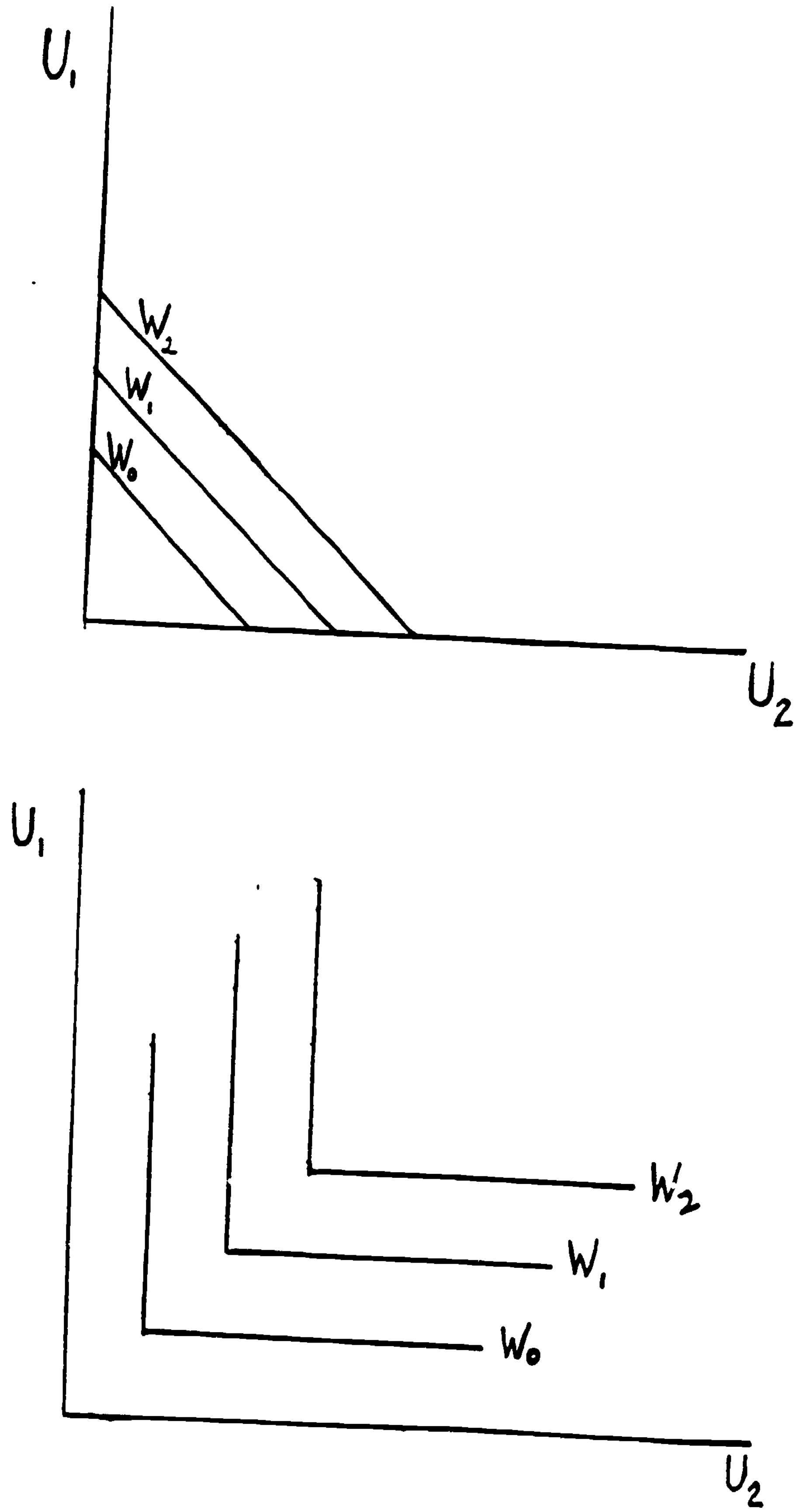
$$(3)\quad U_i = U_i(X_{i1}, X_{i2}, \ldots, X_{in}),$$

where x_{ij} refers to consumption of commodity j by individual i. Totally differentiating (3) gives an expression for the change in individual welfare when consumption changes:

FIGURE 1

(A)

(B)



$$(4)\quad dU_i = (\partial U_i/\partial X_{i1})dX_{i1} + (\partial U_i/\partial X_{i2})dX_{i2} + \ldots + (\partial U_i/\partial X_{in})dX_{in}.$$

The Bergson-Samuelson view is to ignore this decomposition and look at dU_i as a single quantity to be measured. But another view of dU_i shows the importance of its decomposition. In (3) we express utility as a function of commodity consumption; such a function is known as the direct utility function. Alternatively, we can express utility as a function of prices and income by replacing commodities with demand functions for them. This form is known as the indirect utility function:

$$(5)\quad V_i = V_i(p_1, p_2, \ldots p_n, I_i)$$

Substituting the individuals' indirect utility functions for the direct utility functions in the Bergson-Samuelson social welfare function (1) gives the following:

$$(6)\quad W = G(V_1(P,I_1), V_2(P,I_2), \ldots, V_n(P,I_n)),$$

where P is a vector of all prices, and I_i is individual i's income.

Using this formulation of the social welfare function, the change in social welfare due to a change in, say, income, can be expressed as follows:

(7) $dW = (\partial G/\partial V_1)(\partial V_1/\partial I_1)dI_1 + (\partial G/\partial V_2)(\partial V_2/\partial I_2)dI_2 + \ldots + (\partial G/\partial V_n)(\partial V_n/\partial I_n)dI_n$

Comparing (7) to (2) we see that in (7) we are no longer obligated to measure individual welfare changes. The expression $(\partial G/\partial V_i)/(\partial V_i/\partial I_i)$ is the marginal social welfare change from a $1.00 change in individual i's income. Like the weights, $\partial F/\partial U_i$, in (2), the marginal social welfare change requires a normative judgment of the benefit to society of changing an individual's income. But in (7), the remaining problem is dI_i, compared to dU_i in (2). Utility changes generally are not comparable across individuals (as discussed below), whereas income changes clearly are. Thus the formulation of social welfare change in (7) simplifies the problem. While the normative dimension remains, the task of the cost-benefit analyst is reduced to finding monetary measures of the effect of a project on individuals. Below we will explore in some depth alternative monetary measures available to the practitioner of cost-benefit analysis.

The formulation of social welfare change in (7) allows us to consider an important case in which the normative problems can be ignored. That is, if:

$$(\partial W/\partial V_i)/(\partial V_i/\partial I_i)$$

is equal for all individuals, then social welfare increases if

and only if aggregate income has increased. In this situation cost-benefit analysis is solely concerned with measuring changes in income across individuals. Much of applied cost-benefit analysis has, in fact adopted this perspective, as evidenced by the popularity among users of the potential Pareto improvement criterion [21, and see below].

The jump from (7) to concern only with income changes, dI_i requires the marginal social welfare of a change in income be equal for all consumers, that is, that a redistribution of income has no welfare effects. In short, this is the case where the many-person economy can be represented, for analytical purposes, as a one-person economy. Richard Tresch has outlined three cases in which "one-consumer equivalence" holds [13].

The first case is attributable to Paul Samuelson. Samuelson considered the case of a society maximizing social welfare. He showed that all individuals in such a society would have the same marginal utility of social income. Society could therefore be analyzed as a single, representative consumer.

That is, let society's objective function be expressed as:

(8) $$W = W(V_i(I_i))$$

subject to a budget constraint:

(9) $$I_i = I$$

In this case, the society maximizes social welfare when the marginal social utility of real income is equal for all

individuals. Samuelson showed that in this case, social preferences could be represented with social indifference curves, and social welfare maximization is the positive task of obtaining the highest social indifference curve.

Even if the distribution of income is not, at the outset, optimal, the assumption of homothetic and identical preferences guarantees that social welfare will not change with a redistribution of total income. Homotheticity is the property of a function which is a monotonic transformation of a homogeneous function. Homothetic preferences imply a constant income elasticity of demand. That is, the relative composition of consumption is invariant to income changes. Homothetic preferences give rise to income-expansion paths that are a ray from the origin, as depicted in figure 6. Identical preferences implies equal income elasticities of demand for all consumers. Thus, assuming homothetic and identical preferences, for any change in the distribution of income, the percentage increase in demand due to a gain in income for some individuals, will be exactly offset by the percentage decline in demand by those losing income. Social welfare is unchanged.

Feldstein defined the "distributional coefficient" of good k, 0_k, as the sum of all individuals' marginal social welfare of consuming good k, weighted by each individuals' share of total consumption of good k:

(10) $$O_k = \Sigma\ (\partial W/\partial V_i)(\partial V_i/\partial I_i)(X_{ik}/X_k).$$

The distributional coefficient for a good is the sum of the product of each individual's marginal effect on social welfare from an income change and her share of consumption of that good. That is, it is a weighted average of the individuals' marginal social welfares, with relative consumption as the weights. When we assume preferences are homothetic and identical, we guarantee that the distributional coefficients for all goods are equal.

The last case where the "one-consumer equivalence" is an acceptable simplification of the social welfare measurement problem was derived by Jerry Green. He showed that if the covariance of $(\partial W/\partial V_i)(\partial V_i/\partial I_i)$ with X_{ik}/X_k equals its covariance with X_{ij}/X_j across all goods and consumers, then the marginal social welfare of a change in income is the same for all individuals.

The conditions necessary for cost-benefit analysis to ignore distributional considerations in evaluating a project are admittedly stringent. More important, according to Tresch, "none of the three sufficient conditions is a likely description of reality." [13, p. 85] But in the event that any of these conditions holds, the cost-benefit analyst can concentrate strictly on the individual real income changes (dI_i) resulting from a project. These monetary measures and their aggregation across individuals will be the concern of the rest of this paper.

II. Individual Welfare Measurement

A. Cardinal versus Ordinal Utility and Welfare Analysis

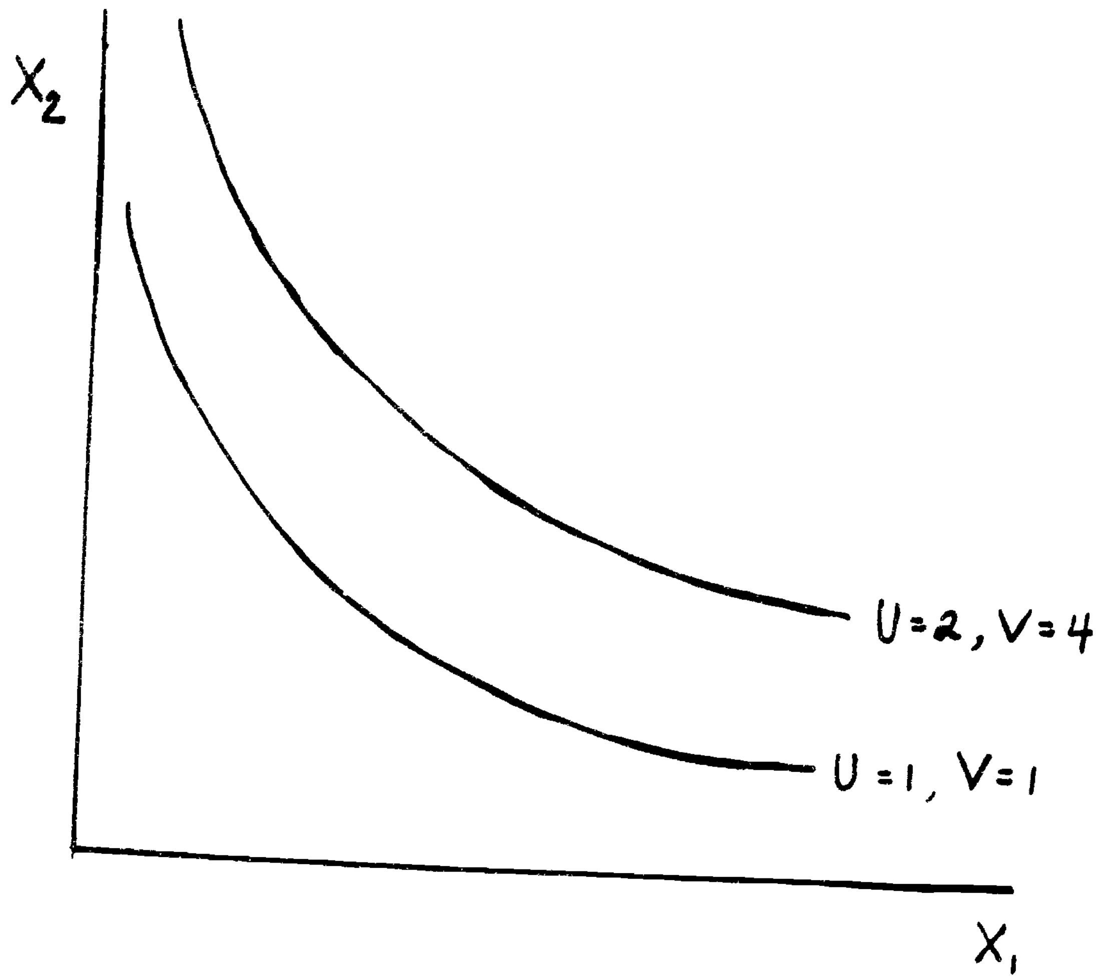
A cardinal magnitude is a variable whose measurement permits arbitrary choice only of zero-point and unit interval. For an ordinal magnitude the only meaningful comparisons are equality or else ordering of magnitudes. Temperature is an example of a cardinal measure; centigrade and farenheit scales differ, but only in terms of the zero point and unit interval [4].

The distinction between ordinalism and cardinalism in consumer demand theory is that an ordinal utility function generates a ranking of different consumption possibilities without specifying the intensity of satisfaction from each bundle. Thus ordinal rankings are invariant to any monotonic transformation of the utility function. A cardinal ranking of consumption possibilities provides more information about preferences. Such a ranking is invariant only to increasing affine transformations.

The ordinalism of utility functions is expressed in the fact that numerical values assigned to indifference curves may be transformed without influencing the representation of demand behavior. Thus, in figure 2, whether the indifference curves are labelled according to U or V has no bearing on the implied demand behavior.

The original marginalists, such as Menger, Walras and

FIGURE 2



Gossens, viewed the utility function as a way of measuring individual well-being in cardinal terms. But Fisher and Pareto recognized that cardinal utility was not necessary to a theory of demand. This argument was clearly put forth by J. Hicks in his 1937 book, Value and Capital. Hicks showed that all the results of utility maximization could be generated without assuming cardinal utility, but only ordinal utility [3].

What meaning does the ordinal/cardinal distinction have for cost-benefit analysis? The issue is perhaps clearest by recalling (1), the Bergson-Samuelson social welfare function, $W = F(U_1,\ldots,U_n)$. If utility is ordinal, then U_i is invariant to any monotonic transformation. But as a measure of the magnitude of welfare levels of individuals, U_i is useless. Ordinal utility functions thus require the development of a scale, a way of measuring in common units, preferences of different people. Since we cannot measure utility directly we must find an indirect method of measuring individual intensity of preference for or against a change in economic conditions. Such measures would provide a foundation for cost-benefit analysis and be consistent with modern consumer theory.

B. The Evolution of Consumer's Surplus

Before defining the Hicksian measures of individual consumer welfare, we will first discuss the traditional, and still most popular, measure - consumer's surplus. Even today, most cost-benefit analysis is largely an extension of work on consumer's surplus done by the engineer Charles Dupuit in the 1840's and Cambridge economist Alfred Marshall at the turn of the 20th century [6]. After defining consumer's surplus and tracing its evolution in the history of economic thought, we will outline its theoretical limitations. Then we define the alternative Hicksian measures, before moving on to the issue of aggregating individual welfare change measures.

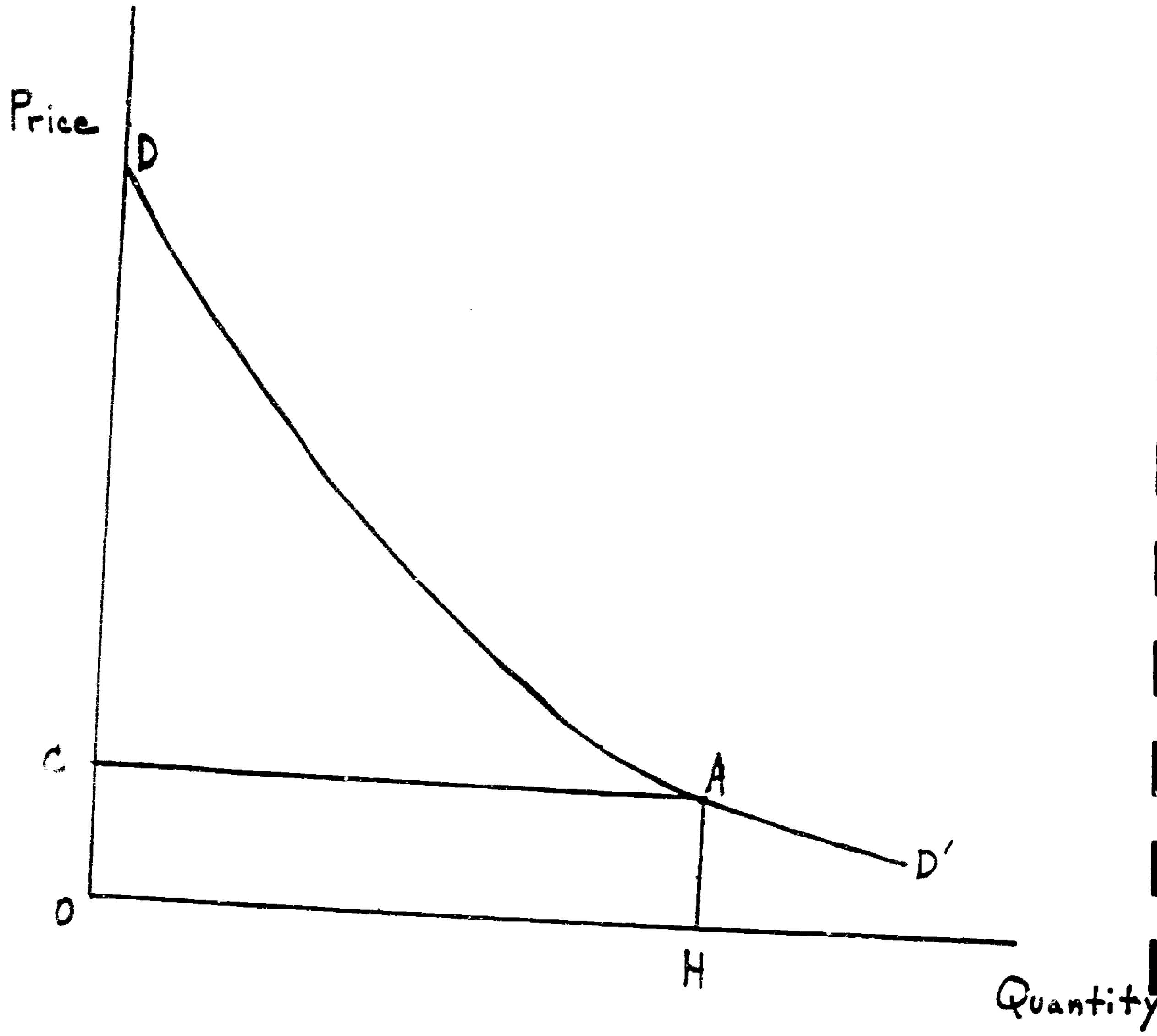
Dupuit's famous 1844 article, "On the Measurement of Utility of Public Works," was the first recognition that the price paid for a good is, generally, not equivalent to the value of the good to the consumer. Jean-Baptiste Say had earlier argued that price equals the average utility from consuming the goods. But Dupuit claimed the price represents not the average utility of consuming the goods, but the utility gained in consumption of the last unit of the good, that is the <u>marginal utility</u>. Dupuit assumed that individuals' preferences exhibited diminishing marginal utility. If smaller quantities of the good were supplied, then the value of the last good consumed would have brought greater satisfaction. Since in the market, in the

absence of price discrimination, a uniform price is charged on all goods, the price paid by the consumer represents the utility to that consumer of the last unit purchased. For other units the consumer would theoretically have been willing to pay more than the market price. Thus actual expenditure understates the total utility in consumption.

Dupuit's understanding of price as marginal, as opposed to average, value led to an interpretation of the demand curve as the marginal willingness-to-pay curve. That is, the price associated with any quantity on the consumer's demand curve is the maximum amount the consumer is willing to pay for the last unit consumed. From this, the notion of a consumer's surplus, the basis for much of contemporary applied welfare analysis, follows almost trivially. It is the aggregate of satisfaction, in dollars, achieved from the consumption of a quantity of a good, less the dollars spent to purchase this quantity.

Like Dupuit, Marshall viewed the market demand curve as a reflection of the "aggregate of satisfaction" derived from the consumption of the good. Marshall gave a geometric representation of consumer's surplus. This is area DOHA in figure 3, which depicts the market demand schedule for tea. Subtracting from this the amount paid for the tea, the price of tea times the quantity consumed (area OCAH), gives the amount of consumers' surplus derived from tea consumption at price AH, or

FIGURE 3



area DCA.

C. The Path-Dependency Problem

Before analyzing the conditions that allow us to use consumer's surplus as a measure of utility change, we first note that consumer's surplus need not be well-defined in cases when the price of more than one good changes, or when prices and income change. That is, we may generate different values for consumer surplus depending on the order in which we consider the various price and income changes. Consumer surplus may be sensitive to the "path of adjustment." This is the so-called path dependency problem [5].

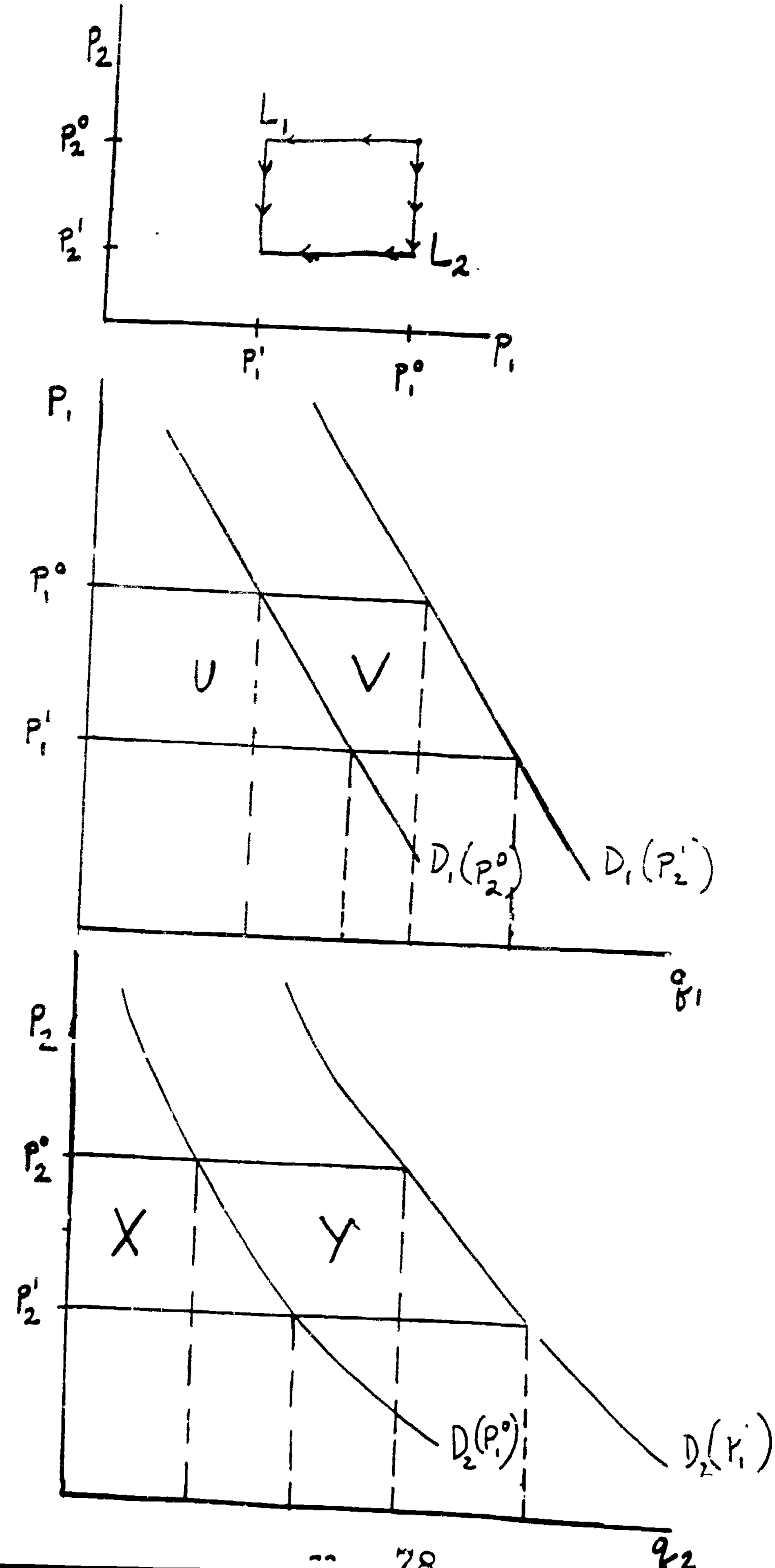
For example, consider the case where the price of two goods changes simultaneously, depicted in figures 4(a)-(c). The prices of q_1 and q_2 change from p_1^0 and p_2^0 to p_1^1 and p_2^1. Let L_1 and L_2 be two possible paths of adjustment. They are depicted in figure 4(a). Along L_1, the p_1 change is considered first, causing a rise in consumer surplus equal to area U. The p_1 fall also causes D_2 to shift out, resulting in a rise in consumer surplus of X + Y when the p_2 fall is subsequently considered. Along L_2 the p_2 fall is considered first, bringing a consumer surplus increase of X plus, when the D_1 shift is taken into account, an additional consumer surplus rise of area U + V. The changes in welfare under paths of adjustment L_1 and L_2 - areas U+X+Y and U+V+X - respectively are in general not equal. The

FIGURE 4

(A)

(B)

(C)



P_2
P_2^0
P_2^1
L_1
L_2
P_1^1
P_1^0
P_1
P_1
P_1^0
P_1^1
U
V
$D_1(P_2^0)$
$D_1(P_2^1)$
q_1
P_2
P_2^0
P_2^1
X
Y
$D_2(P_1^0)$
$D_2(P_1^1)$
q_2

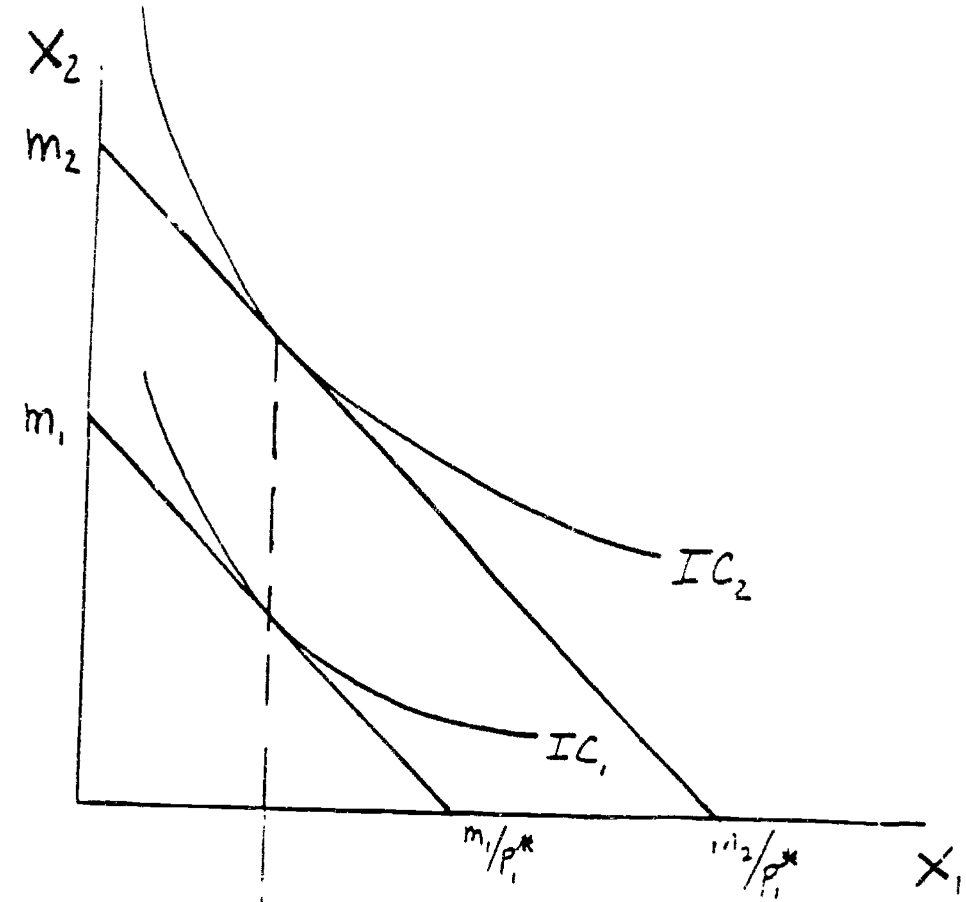
order in which the cost-benefit analyst considers the price changes will affect the ultimate welfare change estimate. This non-uniqueness of consumer's surplus also arises when a price change occurs along with a change in income. Clearly this is an unacceptable property for a welfare measure, and is thus a serious deficiency of consumer's surplus.

We can determine, however, the conditions under which consumer's surplus is independent of the path of adjustment. If these conditions hold, we say consumer's surplus is path independent, i.e. it at least provides a unique measure of welfare change. When many prices and income change, consumer's surplus is unique if and only if the income effects of price changes (and thus income elasticities of demand) of all goods for which prices possibly change along the path of adjustment, equal zero.

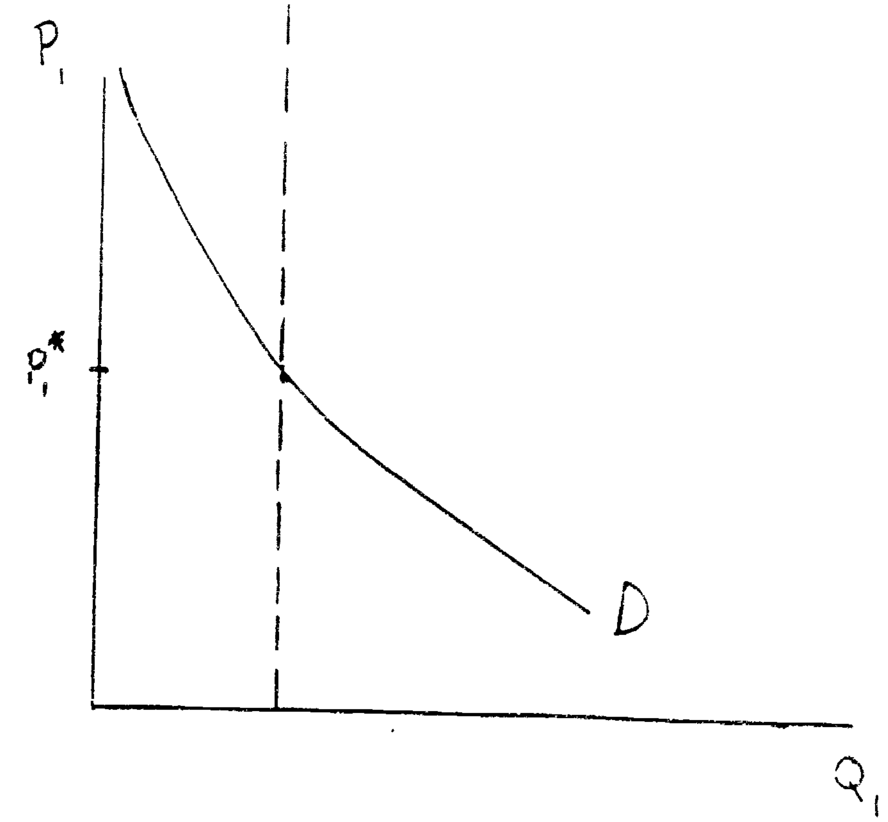
That such a condition guarantees uniqueness of consumer's surplus can be seen in the case of two commodities with the use of indifference curves. If a single price and income change, consumer surplus is unique if the demand curve does not shift following the income change. This occurs when indifference curves are vertically parallel, as depicted in figure 5. A rise in income, say from m1 to m2, results in no increase in the consumption of good one. In other words, the income-consumption path for the good is vertical. As income changes (at a constant price) the same demand curve is generated, as shown by demand

FIGURE 5

(A)



(B)



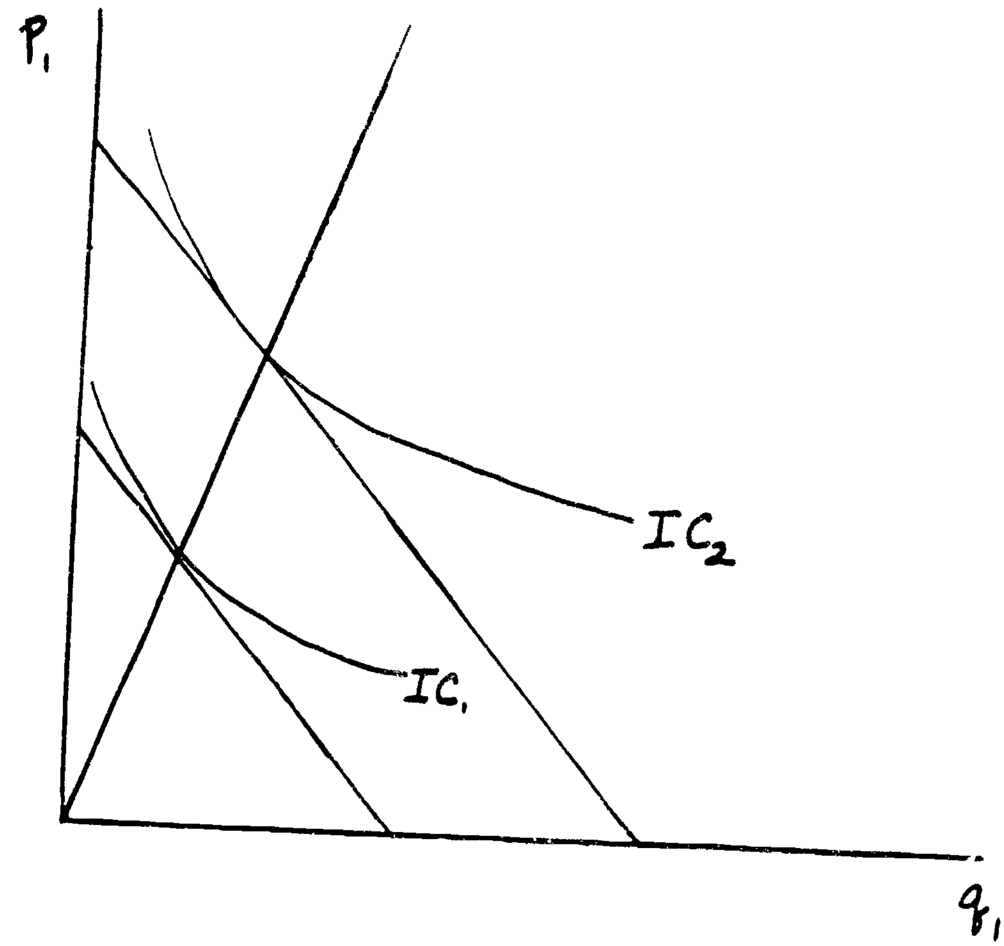
curve D in the figure.

If many prices change, the condition for the uniqueness of consumer's surplus is that the impact of the price change of good A on the demand for good B be equal to the impact of the price change of good B on the demand for good A (i.e. equality of cross-price effects). This condition must hold for all pairs of goods for which prices possibly change in order to have uniqueness of consumer's surplus for the case when many prices change. This condition is equivalent to the condition that all income effects be equal for those goods whose prices change.

The uniqueness condition is easily extended to the case when all prices change. But when income elasticities are equal for all goods, the fact that consumers must satisfy budget constraints implies that income elasticities of demand equal unity. This condition on preferences gives rise to income-expansion paths that are rays from the origin, as depicted in figure 6. Consumer preferences satisfying such a restriction are called homothetic, as defined above.

The important issue is whether these elaborate conditions ever hold in the real world, or whether they are approximately true. The answer is of course an empirical one, but the evidence to date is overwhelming that income effects are significantly positive and that income elasticities of demand are different for different goods. One recent contribution to the debate concludes, "Generally, the conditions for uniqueness of consumer

FIGURE 6



surplus change may be so restrictive as to be unrealistic in many cases." [5, p.80]

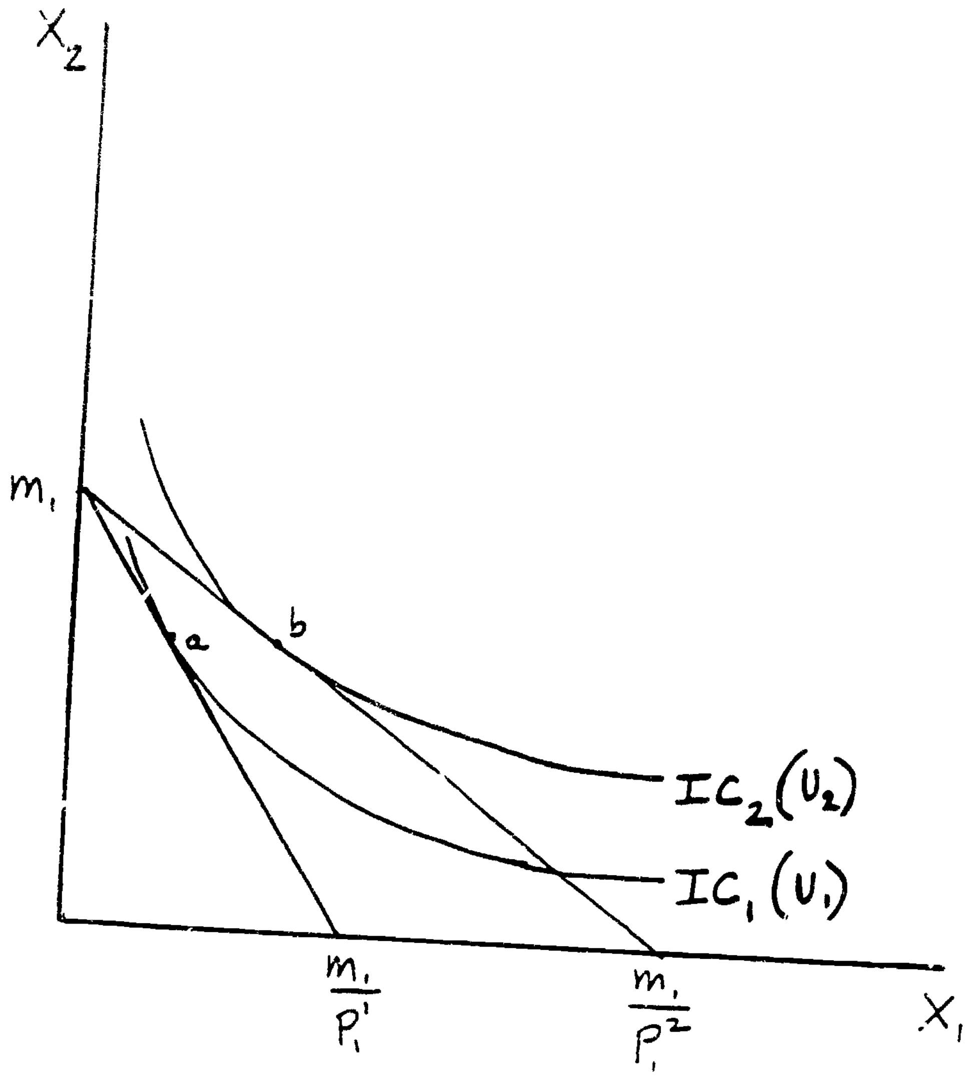
The non-constancy of the marginal utility of income thus renders consumer's surplus meaningless as a measure of individual welfare change. Using consumer's surplus for this purpose is, according to Eugene Silberberg, "using the inappropriate to measure the undefinable." [11, p. 362]

D. Willingness-To-Pay Measures of Individual Welfare Change

Consumer surplus is a valid measure of welfare change only under very restrictive conditions. In the 1940's British economist John Hicks proposed four measures which, while still not directly linked to utility, are a direct reflection of consumer preferences. Hicks' measures are based on the concept of willingness-to-pay, that is a monetary equivalent of the consumer's preference for or against a change in economic conditions (i.e. prices and/or income). The four Hicksian measures, first presented in his famous 1941 article, "The Rehabilitation of Consumer's Surplus," are easily illustrated using consumer indifference curves [25].

Consider a consumer assumed to be a utility maximizer with a strictly quasiconcave (twice differentiable) utility function. This consumer's preferences are depicted in figure 7. Initially, the consumer faces prices P1 and consumes at point a, where her "nice" (i.e. strictly convex) indifference curve, U1, is tangent to the budget line with slope P1. Now suppose government policy

FIGURE 7



lowers the price of good x and the consumer now faces the budget line with slope P2. The rational consumer now consumes at point b, the tangency of her indifference map with the new budget line. This indifference level represents utility U2, where U2 > U1.

The question facing the cost-benefit analyst is, "How much, in monetary terms, has our consumer's welfare improved as a result of the price drop (ceteris paribus)?" As the theory of index numbers implies, an infinite number of measures are capable of representing this welfare change. Two suggested by Hicks are particularly appealing because of their reliance on the idea of willingness-to-pay.

The compensating variation (CV) is the change in income necessary to just compensate the consumer for the loss of utility due to a price increase. The equivalent variation (EV) is the amount of income that would have to be taken from the consumer to make the consumer as well off after the price decrease.

The CV and EV can be derived using the expenditure function, also known as the cost-of-utility function. The cost-of-utility function is derived by determining the minimum expenditure (at a given set of prices) required to attain a certain level of utility. The cost-of-utility function, $E = E(P,U^0)$, thus determines, in dollars, how much money is needed for the consumer to attain a fixed level of satisfaction, given prices. This concept lends itself nicely to welfare analysis. The CV and EV can be calculated as the difference between two expenditure

functions. That is, let P_0, U^0 be initial prices and utility conditions and P_1, U_1 be price and utility conditions following a public investment project. Then $EV = E(P_0, U^1) - E(P_0, U^0)$ and the $CV = E(P_1, U^0) - E(P_0, U^0)$ [14].

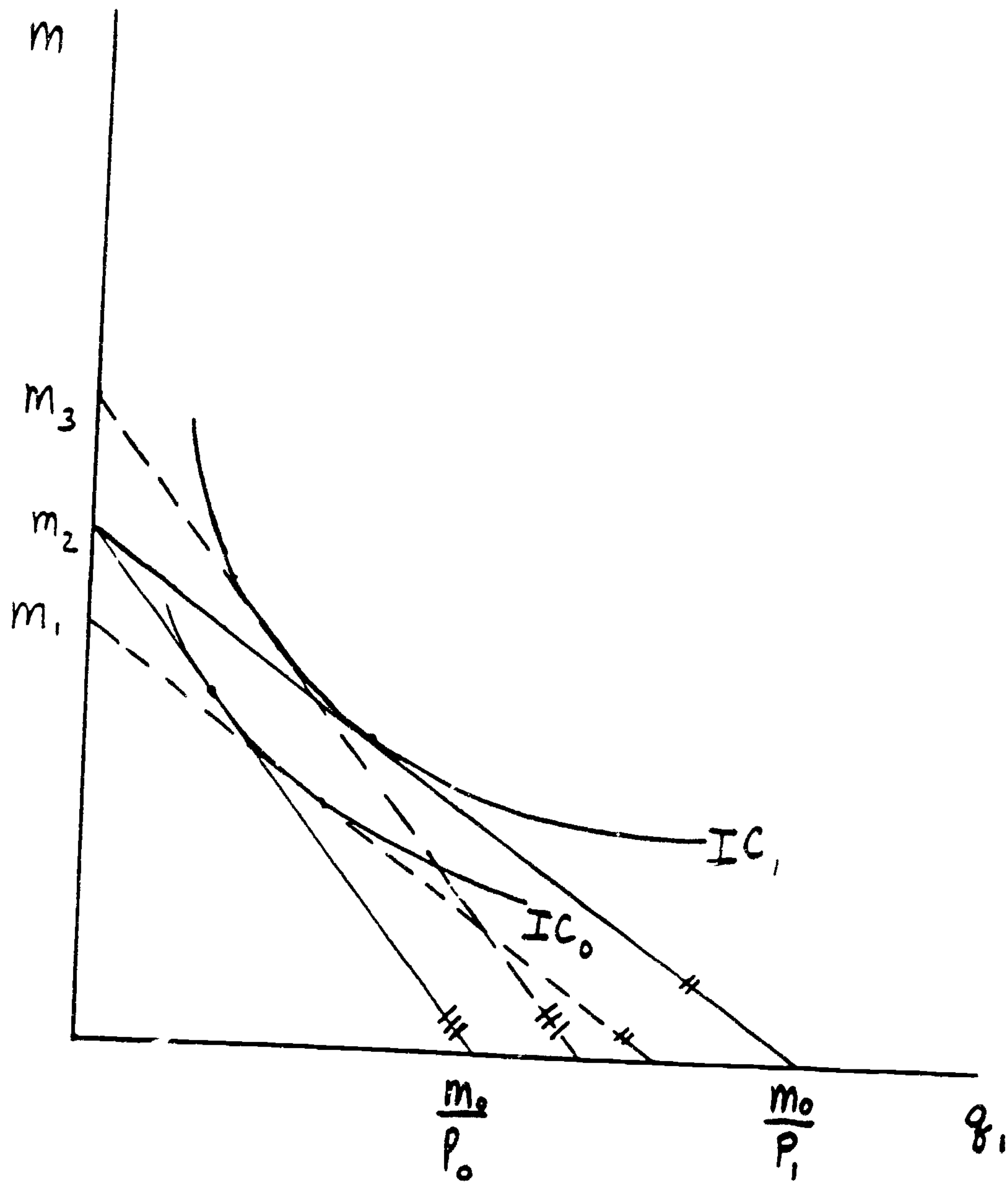
Another derivation of the CV can be made by drawing an imaginary budget line parallel to the relevant budget line following the price change (i.e. with slope P2), tangent to the original indifference curve. The compensating variation can then be measured along the vertical axis (which measures all goods other than x, or income) as the distance between the two parallel budget lines. In figure 8 it is distance m2-m1.

The equivalent variation can be measured along the vertical axis by drawing an imaginary budget line parallel to the initial budget line (i.e. with slope P1) but tangent to the <u>new</u> indifference curve. The EV is the vertical distance between these two parallel budget lines. In figure 8 it is distance m3-m2.

Notice that in the case of a price fall the equivalent variation may not be bounded since the indifference curve may be asymptotic to the vertical axis. This is also true of the CV in the case of a price rise.

Hicks defined two other willingness-to pay measures of welfare change. The <u>compensating surplus</u> (CS) is defined as the increment of a single commodity that could be removed from the

FIGURE 8



new consumption bundle such that the consumer would be indifferent between the modified bundle and the original bundle. In figure 9, let point 1 be the original consumption point, and consider a move to point 2. Then the compensating surplus is dX_n. Taking this amount of X_n away from the consumer leaves her as well off as originally.

The equivalent surplus (ES) is the increment of a single commodity that must be added to the original bundle, such that the consumer would be indifferent between the modified bundle and the new bundle. In figure 9, let point 1 be the original consumption point, and consider a move to point2. Then the equivalent surplus is $-dX^1_n$. Adding this (negative) amount to the original bundle leaves the consumer as well off as with the move from point 1 to point 2 [22].

Considerable debate prevails over the relative merits of the four Hicksian measures. One problem of the CS and CV measures is they are based on the original consumption bundle and measure the money (in the case of CV) or amount of the good (in the case of CS)required to reach the new level of welfare. As a result, two different original consumption bundles that lie on the same indifference curve will bring different measures of money or goods needed to achieve a new welfare level. Figure 10 illustrates this problem for the case of the CV:

Consider consumption bundle a, contained in U_1. If the price of good x falls, the consumer now consumes at point c, on

FIGURE 9

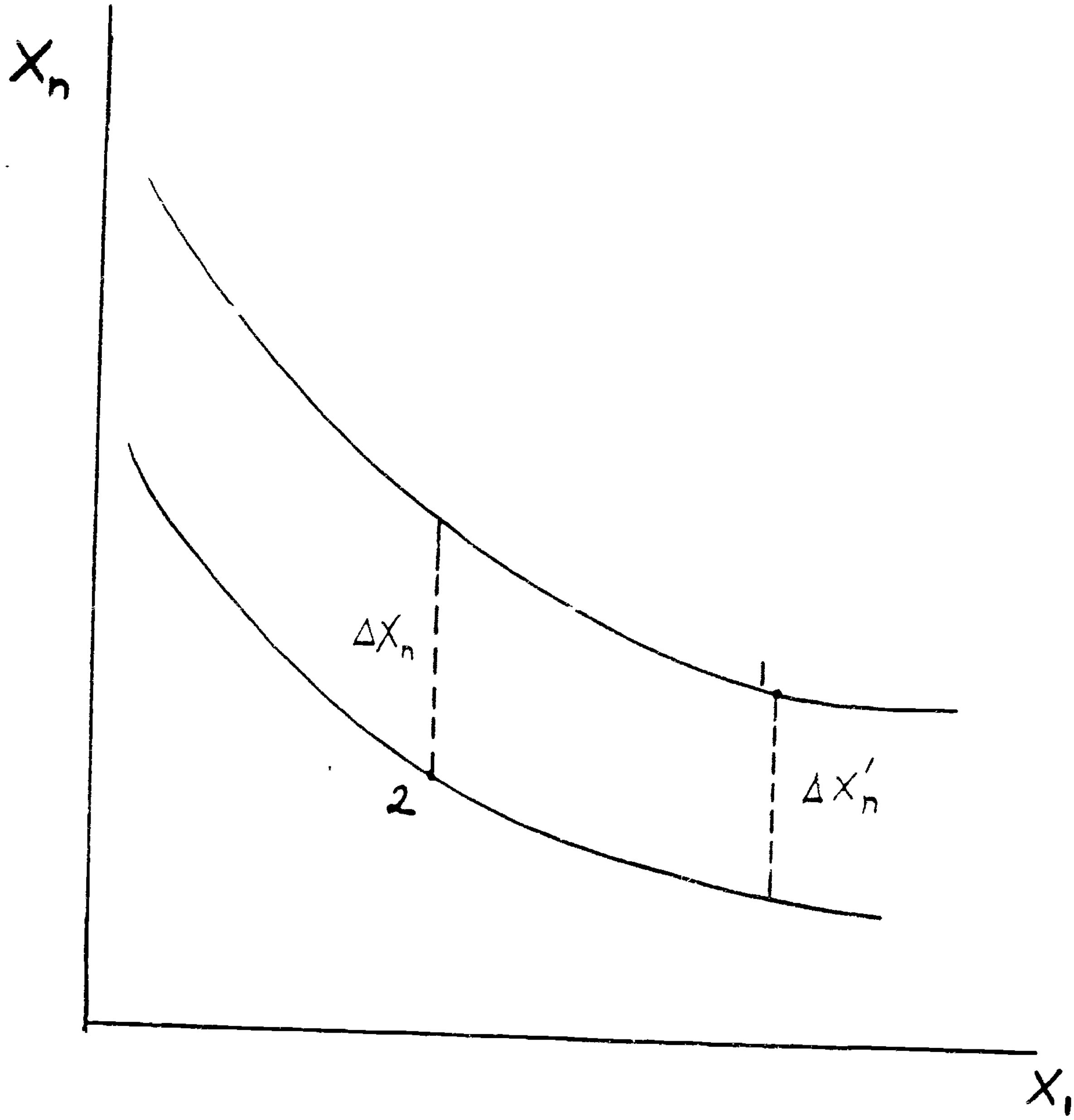
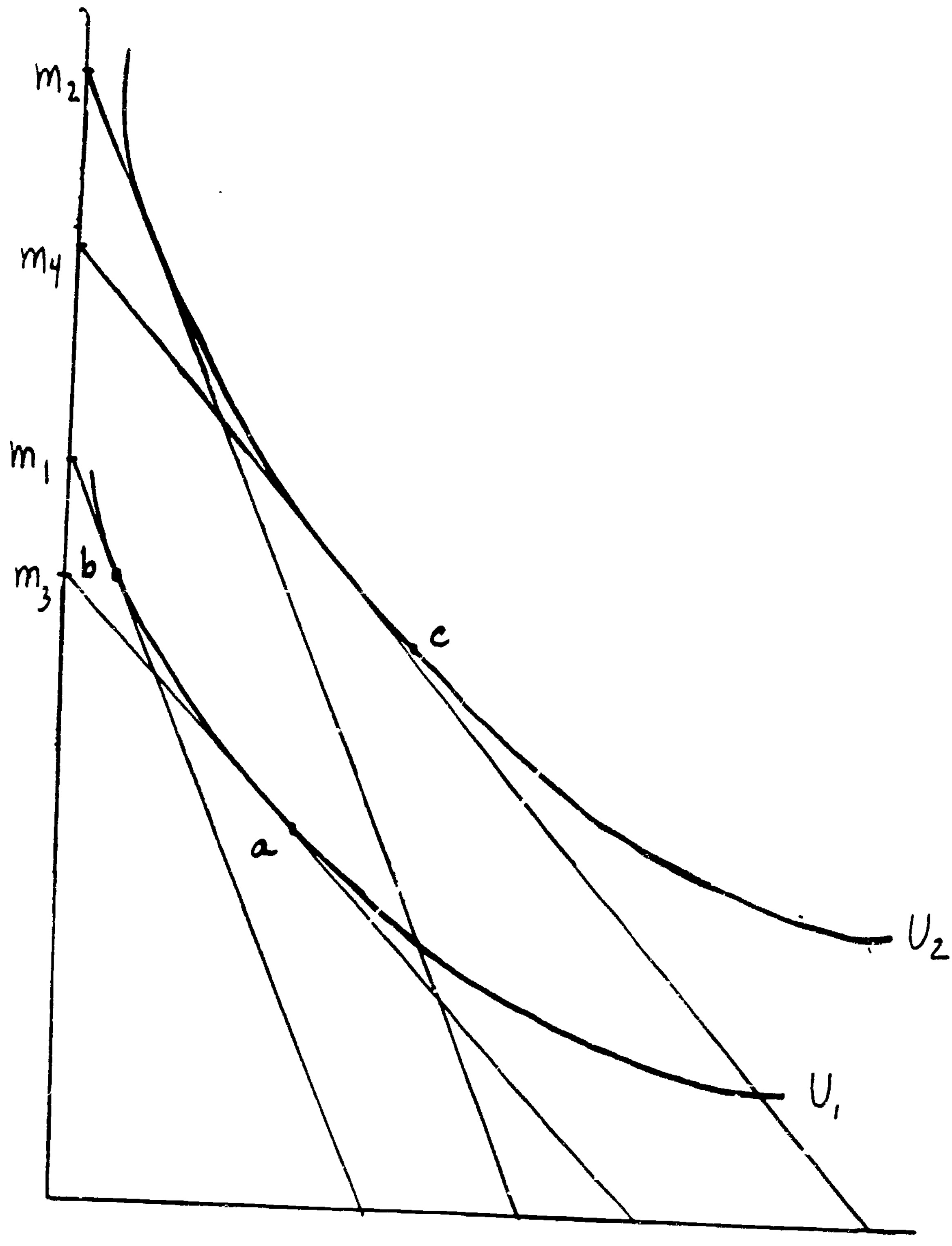


FIGURE 10



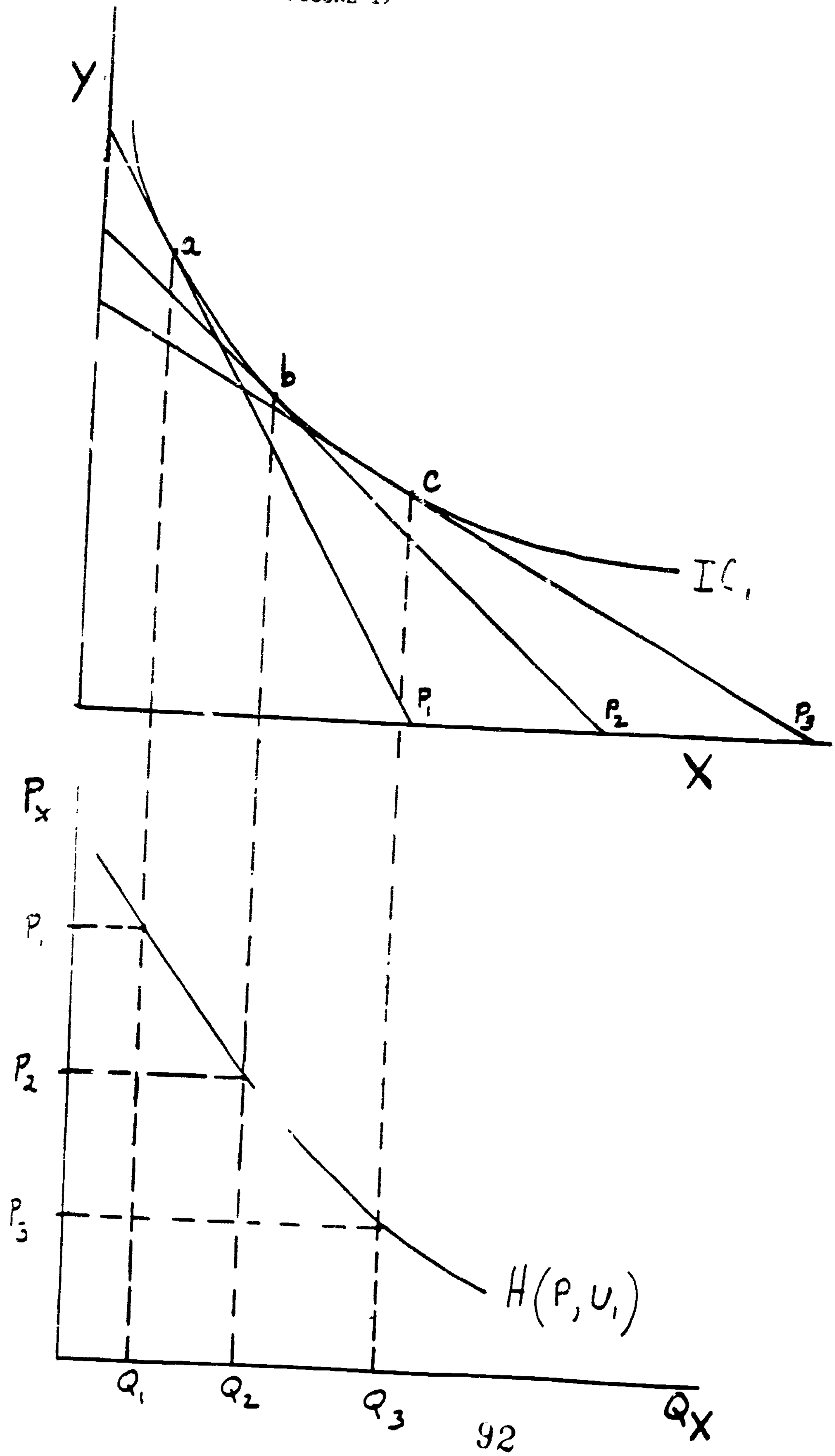
U2. The CV from this price change equals m4-m3, the amount of money the consumer must be compensated to forego the price change yet attain the new level of welfare. Now consider initial consumption bundle b on U1. Suppose the price of x falls such that the consumer can optimally reach U2. The CV of this price fall equals m2-m1. In general m4-m3 does not equal m2-m1. But the welfare change, as far as the consumer is concerned, is the same in both cases. The CV, because it is based on the initial bundle, may map different values on to identical welfare changes. The EV and ES do not have this shortcoming because they are based on the new welfare level, that is, the welfare level following the price or income change.

A comparison of consumer surplus with CV and EV is helpful in understanding economists' affinity for the latter two measures compared to the area under the Marshallian demand curve. The comparison requires the use of Hicksian demand curves. Hicksian, or compensated, demand curves represent the locus of amounts of a good consumed at different prices, holding the utilty level constant as the price changes. The derivation of the Hicksian demand curve is easily seen with the use of indifference curves. In figure 11(a), points a,b and c represent bundles (of x and y) consumed when the price of x changes but utility is fixed at U1. The combination of prices of x and consumption of x are transferred into P_x, Q_x space in figure 11(b). The locus of these points, labelled $H(P,U_1)$, is the Hicksian demand curve.

FIGURE 11

(A)

(B)

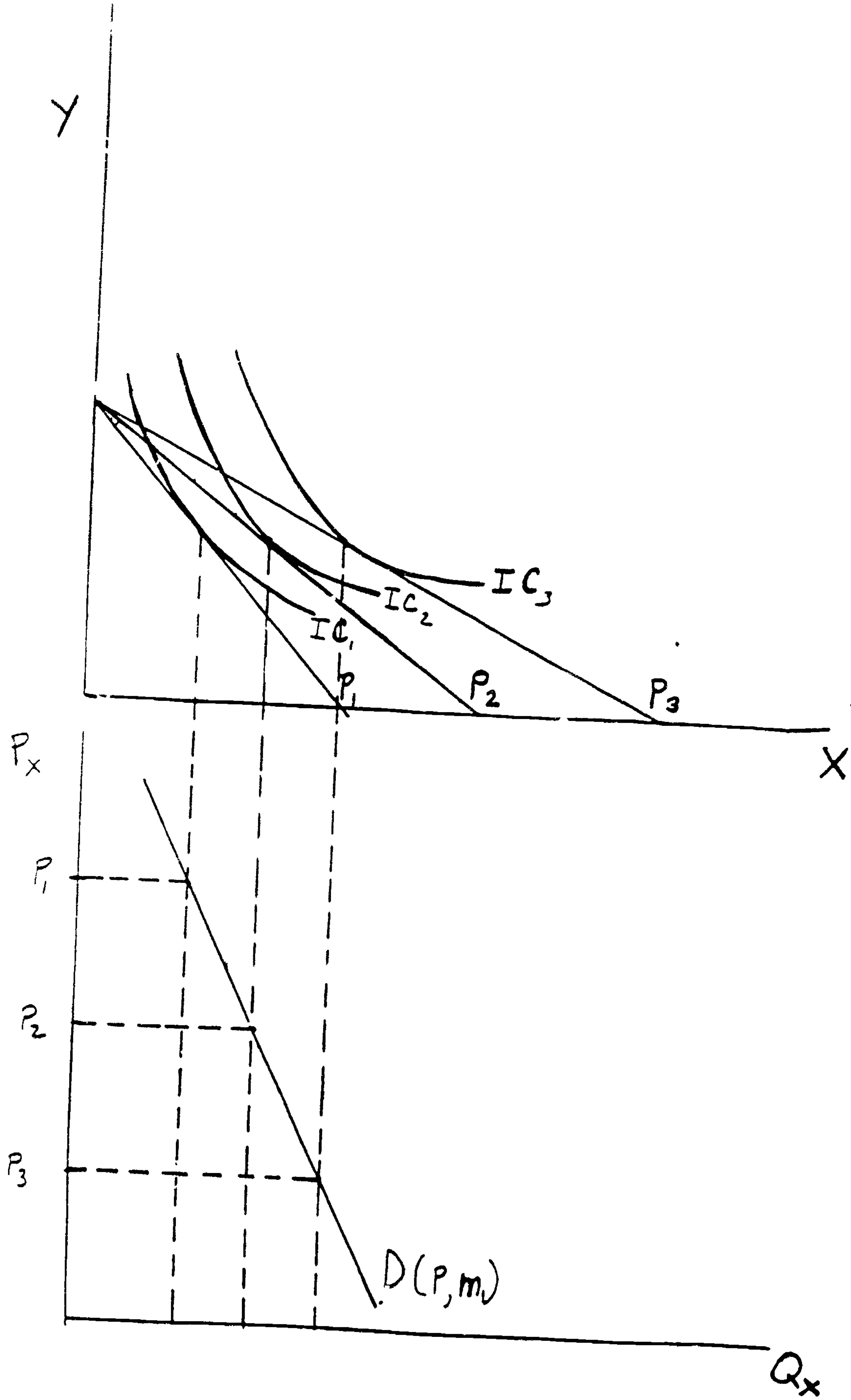


The compensating variation can thus be represented as the area under the Hicksian demand curve demand between the old and the new price of good x. This follows from the definition of CV: the amount of money which must be taken away from a consumer after a price (and/or income) change to restore the consumer's original welfare level. That is, if the price of x falls from p_1 to p_2 then money must be taken away from the consumer if that consumer is to be left as well off as originally. The area under the Hicksian demand curve between the original and new price is that amount of money. The EV can also be expressed as the area under a Hicksian demand curve. But for EV, the measure is made under the demand curve whose argument is the new utility level.

The Marshallian or uncompensated demand curve can similarly be derived with the use of indifference curves. The Marshallian demand curve is the locus of tangencies of indifference curves to the budget line as the price of the good changes. That is, it is the price expansion path for a good, plotted in p,q space. This is depicted in figure 12. As the price of good x falls [and assuming the good is normal, that is, its demand increases (decreases) with a rise (fall) in income], the income and substitution effects reinforce each other, leading unambiguously to a rise in the quantity demanded of x and, ceteris paribus, a higher level of consumer satisfaction.

As stated above, the consumer surplus change associated with a price fall from p_1 to p_2 is the area under the Marshallian, or uncompensated, demand curve between the original and new prices.

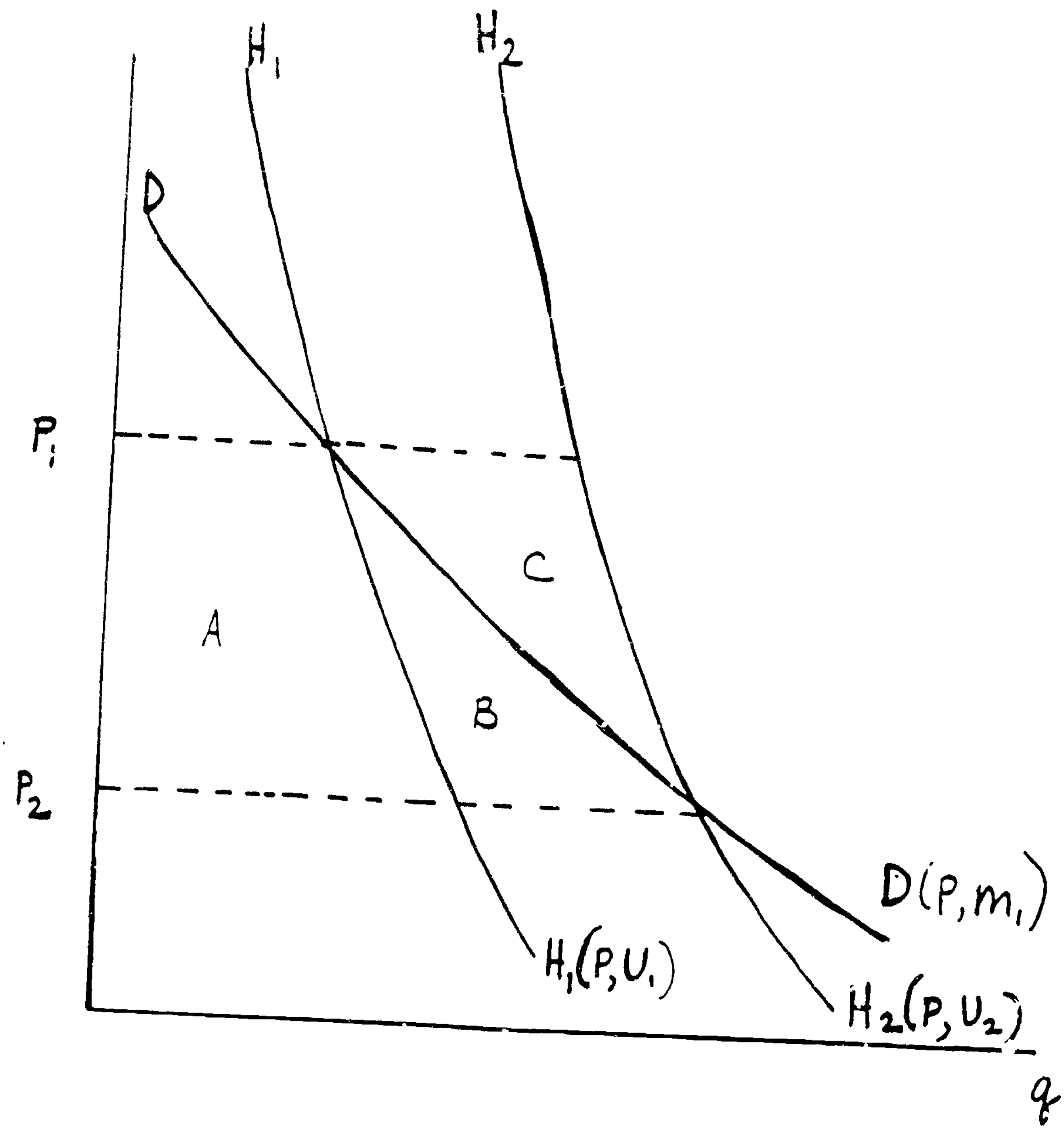
FIGURE 12



How are the Marshallian and Hicksian demand curves related? An answer to this question gives also the link between CV, CS, ES and EV. Intuitively, we can see that for prices below the point of intersection of a Hicksian and Marshallian demand curve, the Marshallian demand curve lies to the right of the Hicksian demand curve. We are, of course, ruling out the possibility of a non-normal good. A fall in the price of good x brings, with income and substitution effects, a rise in the consumption of good x. But if utility is held constant, then the price change will induce only a substitution effect and thus a smaller increase in the consumption of x. Conversely, a price above the price at the intersection of the Hicksian and Marshallian demand curve will reduce consumption of x more if utility is not compensated (i.e. along the Marshallian curve) than if utility is not allowed to fall (as with the Hicksian curve). Thus the Hicksian demand curve is everywhere steeper than the Marshallian demand curve. And if we derive Hicksian demand curves at two different utility levels, U_1 and U_2, the Marshallian demand curve will intersect each of these demand curves at a single point. Obviously, the two Hicksian demand curves, by definition, can never intersect.

This comparison is summarized in figure 13. The Hicksian demand curves are everywhere steeper than the Marshallian demand curve. Consider a price fall from P_1 to P_2. CV is area A, the area under the Hicksian representing the original utility level. The change in consumer's surplus is area A + B, the area under

FIGURE 13



the Marshallian demand curve. The EV, due to the price change, is area A + B + C, the area under the Hicksian demand curve representing the newly attained utility level. Thus, in general, CV < consumer's surplus < EV.

The exceptional case in the above analysis is when there are no income effects. In this case the Hicksian demand curves and the Marshallian curves coincide. This is a particularly interesting case for our welfare measures. When there are no income effects, CV = EV = consumer surplus.

VI. Recent Innovation in Welfare Measurement

When income effects are positive, the Hicksian demand curves and Marshallian demand curve do not coincide, and CV < consumer's surplus < EV. Robert Willig attempted to develop bounds on the difference between the consumer surplus measure and the accurate measure of welfare change as measured by the EV or CV [30]. Willig's article, "Consumer Surplus Without Apology," is now commonly cited as support for the use of uncompensated demand curves in applied welfare analysis. According to Willig:

> These bounds can be explicitly calculated from observable demand data, and it is clear that in most applications the error of approximation will be very small. In fact, the error will often be overshadowed by the errors involved in estimating the demand curve... the results in no way depend upon arguments about the constancy of the marginal utility of income. [30, p.58]

The derivation of the error bounds is mathematically complex, but graphically it is easy to see what Willig is proposing. In figure 13, described above, we see that, for a

single price change (from P_1 to P_2), the compansating variation is area A, the equivalent variation area A+B+C and consumer's surplus area A+B. We have already noted that if there are no income effects, then the three curves coincide, areas B and C disappear, and the three measures are identical. But further, as Willig shows rigorously, if areas A, B and C can be estimated from observable phenomena, then the consumer's surplus measure can be adjusted so that it closely approximates the CV and EV. Area B can be approximated using the income elasticity of demand. The adjustment derived by Willig is thus a function of the elasticity of demand and the observable price and quantity change:

For a single price change, if

$/NA/2m^0/ <= .05$, $/MA/2m^0/ <= .05$

and if $/A/m^0/ <= .9$ then

(i) $(M/A/)/2m^0 <= (C-A)//A/ <= (N/A/)/2m^0$

and

(ii) $(M/A/)/2m^0 <= (A-E)//A/ <= (N/A/)/2m^0$

where

A = consumer's surplus area under the demand curve between the two prices (positive for a price increase and negative for a price decrease)

C = Compensating variation corresponding to the price change.

E = Equivalent variation corresponding to the price change.

m^0 = consumer's base income.

N and M = respectively the largest and smallest values of the income elasticity of demand in the region under consideration.

Willig argued that only in "rare cases" will such percentage error bounds be exceeded. But his approach has other limitations. For one, his formula relies on the change in real income due to a price change being a very small fraction of total income. Moreover, if the income elasticities of demand used in the formula are correctly estimated, such estimation is of a full system of demand equations. But if information exists to estimate a full system of demand equations, then the Hicksian demand functions can also be estimated. In this case, the CV and EV can be calculated directly and do not have to be approximated.

While Willig's "approximations" have been taken as a justification for continued use of consumer's surplus in applied welfare analysis, Yrgo Vartia recently developed an algorithm for calculating compensated income (and thus CV and EV) in terms of direct demand functions [29]. Vartia relies on the assumption that the integrability conditions hold. These commonly-assumed conditions on preferences allow one to posit the existence of a well-behaved utility function. But instead of proceeding to discover this underlying function, (often an impossible algebraic

task), Vartia develops an algorithm to directly calculate the compensated income levels needed to make an "exact" measure of welfare change due to a change in economic conditions. This makes possible the calculation of CV and EV for classes of preferences previously excluded from applied welfare analysis. According to Vartia:

> Our analysis allows the assumption of explicit parametric form of the utility function to be dropped...our paper makes it possible to work with and estimate more general forms of demand functions, adjust the estimated functions to satisfy the integrability conditions ...in the relevant region, and carry out arbitrary ordinal welfare comparisons in this region [29].

This is a significant breakthrough because specific functional forms require very restrictive assumptions, such as no income effects (constant returns to scale Cobb-Douglas), or constant elasticity of substitution (CES).

To summarize, recent efforts to use observable phenomena to calculate accurate welfare change measures have gone in two directions. Willig derived error bounds for consumer's surplus as an approximation of EV or CV. Vartia, in perhaps a more fundamental innovation, found an algorithm for deriving compensated income (and thus CV and EV) from observable price and quantity data without integrating back to the explicit utility function. Unfortunately Vartia's innovation has not, to date, been integrated into applied welfare analysis.

III. Social Welfare Measurement

A. Aggregation for Cost-Benefit Analysis

If there is controversy over the optimal measure of individual welfare, there is perhaps even greater dispute over the method of aggregating individual welfare changes to measure changes in social welfare At the disaggregated level, consumer's surplus serves as a kind of benchmark, to which other measures are compared. Analogously, social welfare measures are commonly compared to the principle of Pareto optimality [See, for example, the presentation in 2].

Pareto optimality is defined as a state where no one can improve their welfare without someone else's welfare being reduced. Accordingly, the Pareto criterion calls for selecting any project that increases the welfare of at least one individual without leaving anyone else worse off.

The main weakness of the Pareto principle is that it does not provide a basis for comparing different Pareto optimal points. Generally, a decision rule that can judge the merits of all possible alternatives is called complete. The Pareto principle does not satisfy the completeness property.

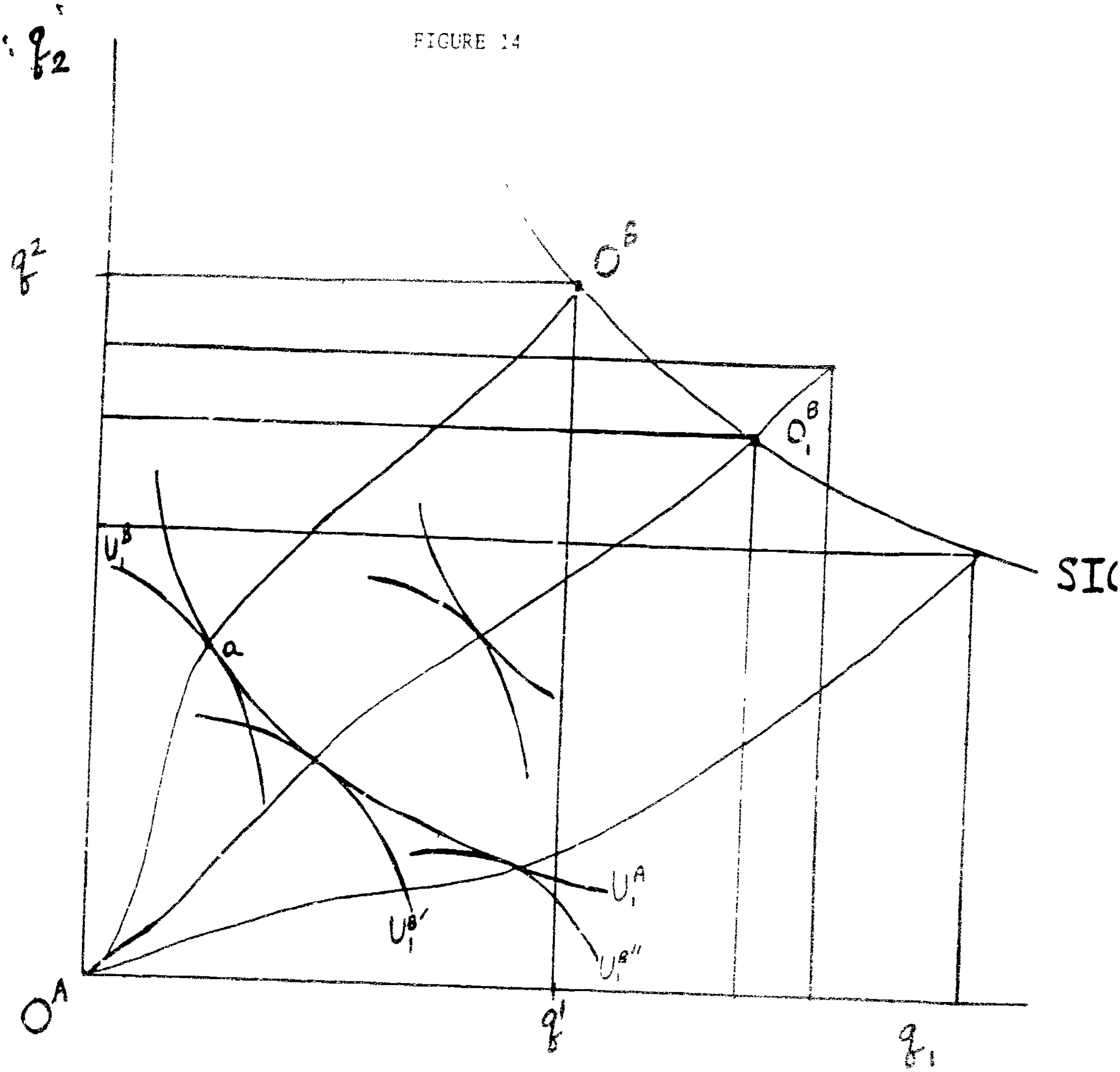
In an attempt to overcome this shortcoming of the Pareto principle, Kaldor and Hicks developed in 1939 the compensation principle as a basis for social welfare decisions [24,26]. The compensation principle states that a project should be undertaken if individuals' gains from the project exceed individuals'

losses. That is, a project should be undertaken if the "gainers" (those who gain from the project) could compensate the "losers" (those who are made worse off with the project) and still, after paying compensation, be better off than without the project. The Hicks-Kaldor criterion is thus known as the compensation principle.

The link between the compensation principle and the Pareto principle is important. The compensation criterion says that a project should be accepted if gainers could <u>potentially</u> make losers as well off as without the project and still be better off themselves. Appropriately, the compensation criterion is also known as the potential Pareto improvement criterion. The important point is that, as Hicks and Kaldor stated the criterion, whether compensation occurs is irrelevant. The cost-benefit analyst should, according to this rule, only point out the <u>potential</u> superiority of one state over another, not recommend that the movement be made or not. If compensation takes place, then we have a Pareto improvement.

A useful tool in determining preferred allocations according to the Kaldor-Hicks criterion is the Scitovsky indifference curve. Figure 14 shows how the Scitovsky indifferece curve (herein SIC) is derived. Suppose initially output is q^1, q^2 and allocation is at Pareto optimal point a. The SIC corresponding to point a is derived by holding Q_A fixed and changing Q_B. Since

FIGURE 14

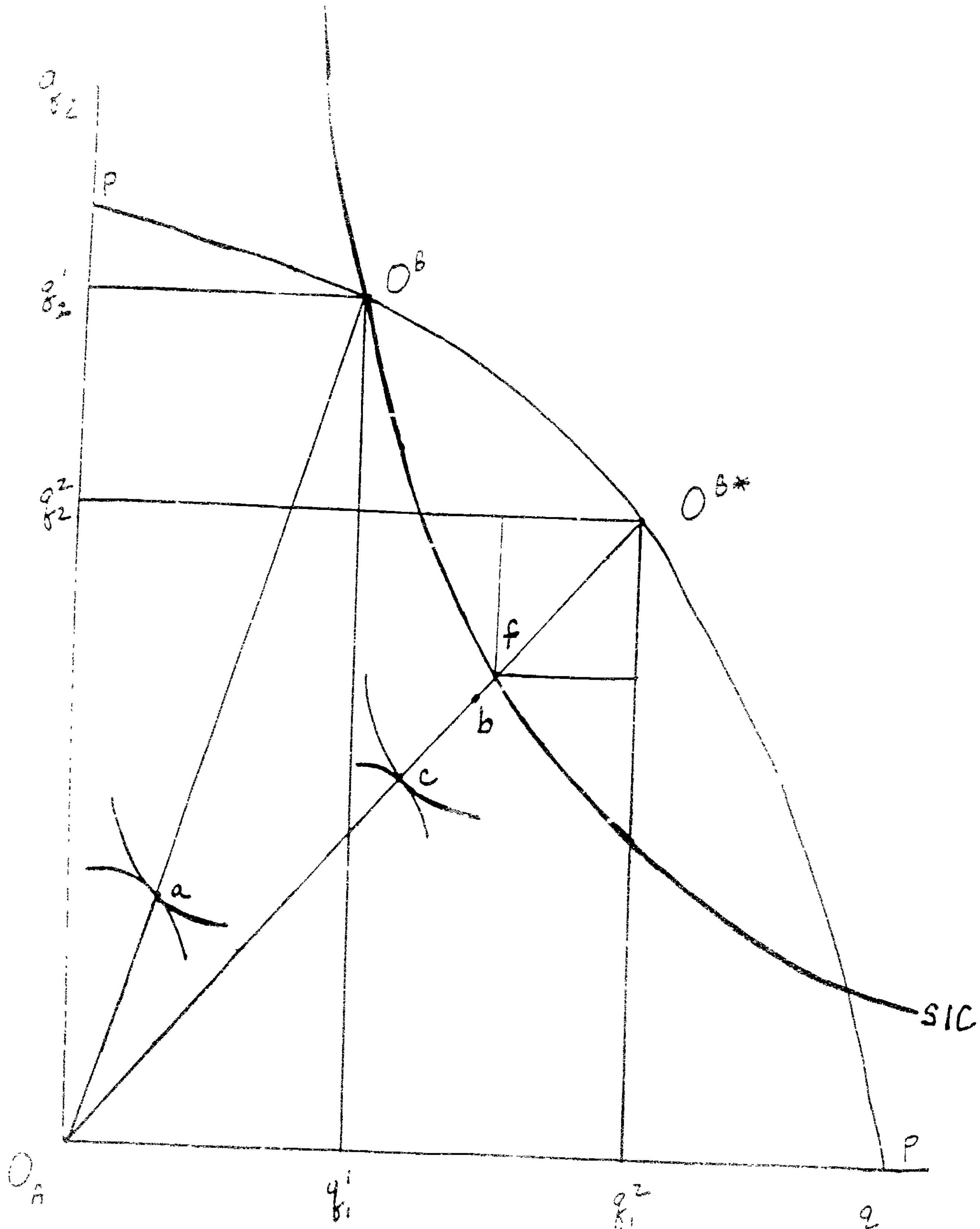


O_A is fixed, A's indifference map stays the same; B's is altered. Change O_B such that B's indifference map contains an indifference curve representing the same utility as U_1^B and is tangent to A's indifference curve containing a, representing utility level U_1^A. The new output bundle, O_1^B, that gives such a result is contained on SIC_1. In general, the Scitovsky indifference curve is the locus of total output bundles just sufficient to allow all agents to achieve a vector of specified utility levels [5].

The Scitovsky indifference curves are thus helpful in evaluating alternative "states of the world" according to the Kaldor-Hicks criterion. Output levels lying on a SIC above (i.e. north east) the SIC containing the alterrative bundle are superior to this alternative bundle by the Kaldor-Hicks criterion. The logic can be seen in Figure 15.

SIC_1 corresponds to output bundle O^* and allocation a. Compare O_B to O_B^b. At point b individual A is better off and individual B is worse off. Thus by the Pareto criterion b is not superior to a, and a is not superior to b. But the Kaldor-Hicks criterion depends on the magnitude of the gains and losses to each individual. Thus if the gains to individual A are greater (in money terms) than the losses to individual B, then b is superior to a by the Kaldor-Hicks criterion. How do we know if this is, in fact, the case? Point f could be attained in an economy producing q_1^2, q_2^2 and point f, since it lies on SIC_1, could support an allocation where all agents are as well off as

FIGURE 15



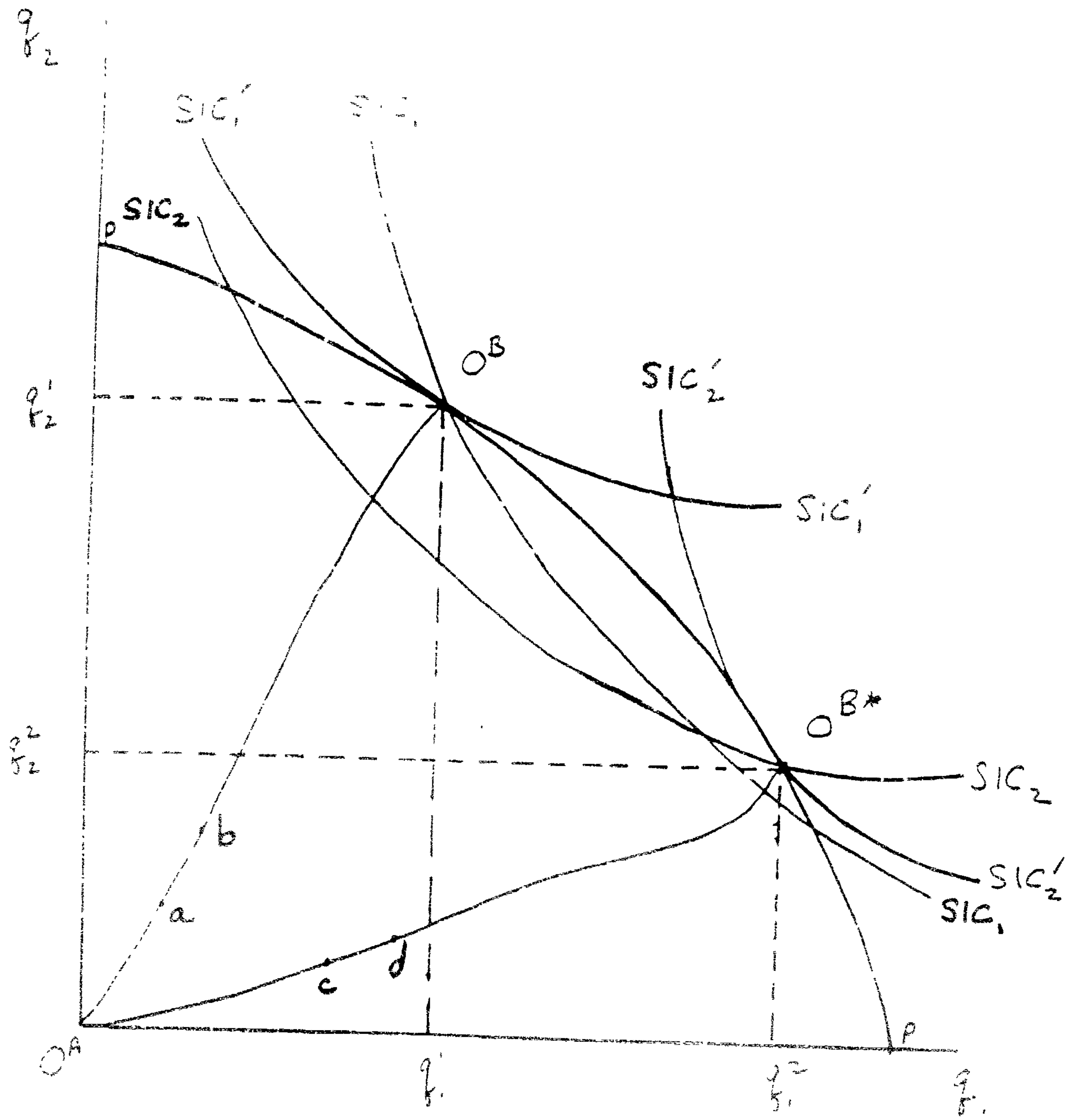
at point a. But O_b^* lies to the northeast of point f. Thus a move from O_B to O_B^* <u>could</u> leave everyone better off. This move thus satisfies the potential Pareto improvement criterion.

T. Scitovsky pointed out that the Kaldor-Hicks (herein K-H) criterion leads to reversals of social choice [28]. That is, if state A is superior to state B by the K-H criterion, once the move to A is made, it is possible for state B to be superior by the same criterion. Figure 16 depicts a reversal. Compare O_B at a and O_b^* at c. O_b^* at c is superior to O_B at a by the K-H criterion, since from c we could move to d where all are better off. Point d at O_B^* corresponds to SIC^1_2. If no compensation is paid, then compare O_B^* at c with O_B at a. From a, we could move to b, where all are better off than at c. Thus O_B at a is superior to O_B^* at c by the K-H criterion. Point b at O_B^* corresponds to SIC_{11}. This is the reversal, which arises because the status quo is compared to all allocations from the alternative state.

Scitovsky attempted to overcome the reversal problem by establishing a criterion whereby a is superior to b if a is superior to b by the K-H criterion and b is <u>not</u> superior to a by the K-H criterion. According to Scitovsky:

> We propose, therefore, to make welfare propositions on the following principle. We must first see whether it is possible in the new situation so to redistribute income as to make everybody better off than he was in the initial situation; secondly, we must see whether starting from the initial situation it is not possible by a mere redistribution of income to reach a position superior to the new situation, again from everybody's point of

FIGURE 16



view. If the first is possible and the second impossible, we shall say that the new situation is better than the old was. If the first is impossible and the second possible, we shall say both are impossible, we shall refrain from making a welfare proposition. [26, quoted in 2, p.149]

An important problem with the Scitovsky criterion (and the K-H criterion as well) is that it may lead to intransitive ranking of alternatives. That is, it is possible for a to be preferred to b and b to be preferred to c, but for c to be preferred to a. [see 1, 9, 18]

Paul Samuelson criticized the K-H and Scitovsky criteria essentially on these grounds, and proposed an alternative [27]. Samuelson said that even if the gainers could compensate the losers and the losers could not then profitably bribe the winners to reverse the project (i.e. the K-H and Scitovsky criteria are satisfied) then we can still not determine the preferred alternative. What is required is not to compare all accessible bundles from one allocation to another bundle, but to compare all accessible bundles from one allocation with all those accessible from the other allocation. Samuelson used the concept of the utility possibility frontier, or the locus of combinations of levels of utility in a given state of the world. By Samuelson's definition, an unambiguous social choice could be made between alternatives only if the utility possibility frontier under one alternative is everywhere above the utility possiblity frontier for the other alternative. If the utility possibility frontiers cross, then there exist accessible distributions in each state of

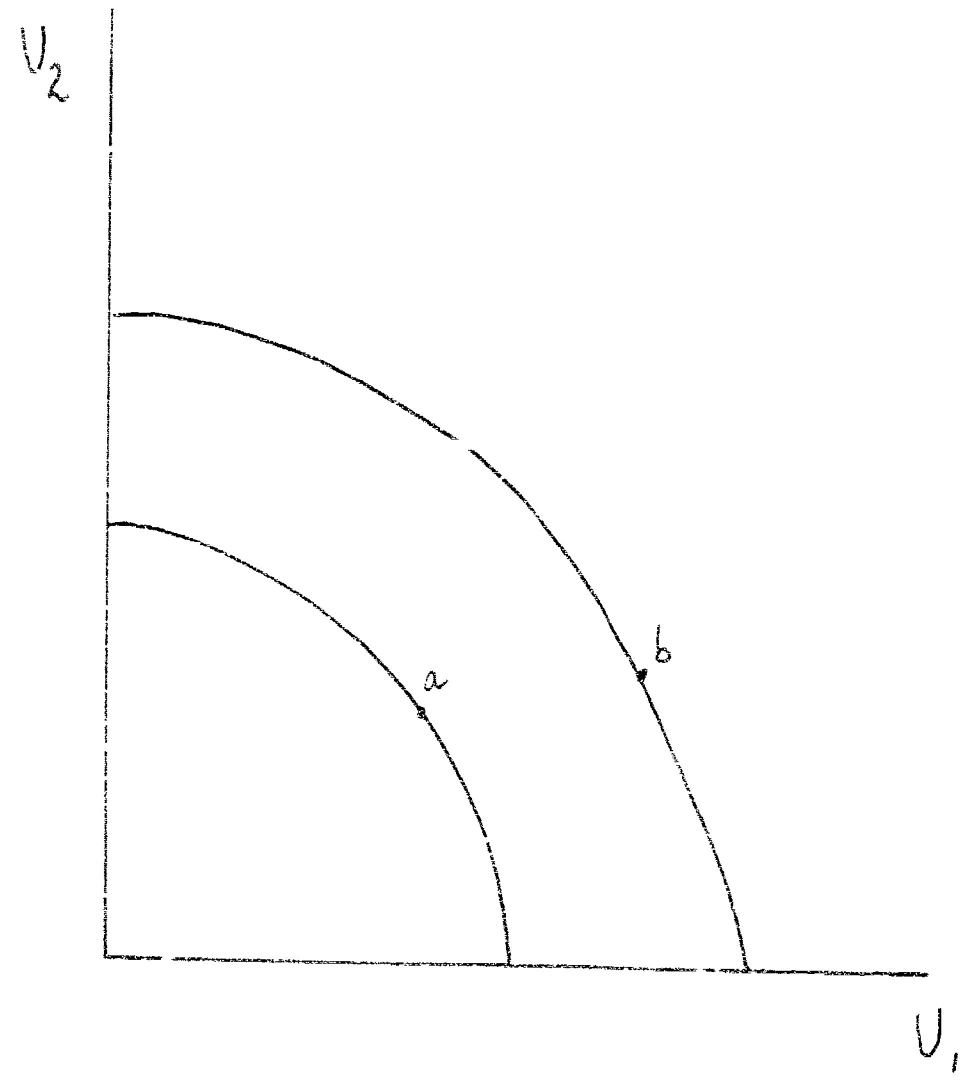
the world superior (by the Pareto criterion) to distributions in the other state of the world, and thus no clear superior alternative exists. In Samuelson's words:

> The Scitovsky conditions are themselves definitely unsatisfactory. It is not enough to double the 1939 conditions [i.e. the Scitovsky criterion] - we must increase them infinitely. Instead of a two point test we need an infinitely large number of tests - that is to say, we must be sure that one of the utility-possibility functions <u>everywhere</u> lies outside the other...Just as Scitovsky has criticized Kaldor and 'compensationists' for assuming the correctness of the status quo ante, so we must criticize him for assuming in some sense the correctness of the status quo ante and/or the status quo post. [27, p.10]

Figures 17(a) and (b) illustrate Samuelson's argument. In figure 17(a), b is superior to a according to the Scitovsky Samuelson calls this result "false because there are points on each frontier superior to some points on the other frontier. To Samuelson, the only satisfactory definition of a social improvement (in his words, an increase in real national income) is when the utility possibility frontier is above the other frontier, as shown in figure 17(b).

Samuelson's result dealt another blow to the attempt to establish objective criteria for social decision making. He states, "The new welfare economics does not go all the way in settling the problems of normative policy: taken by itself, and without supplementation, it goes virtually none of the way..." [25, p. 11]

FIGURE 17



B. Which Criterion for Cost-Benefit Analysis?

Cost-benefit analysis is sometimes taken to be synonymous with the application of the Kaldor-Hicks criterion. As described above, this criterion is not above criticism. Yet it is simple to apply and it is complete, that is all alternatives can be compared. The Scitovsky and Samuelson criterion do not give much more information than the Pareto criterion, which itself was seen to not satisfy the property of completeness. Moreover, we saw that the social welfare function, while theoretically most general, is difficult to apply in practice because of the contentious issue of the appropriate weights. As a result, the Kaldor-Hicks criterion is often adopted for cost-benefit analysis.

We saw that on a purely logical level the Kaldor-Hicks criterion suffers from potential reversals. Obviously a cost-benefit analyst should not recommend that the bridge be built, then upon further analysis recommend it be destroyed. But also from a normative viewpoint, the potential Pareto improvement criterion has been criticized for ignoring the distributional impact of public investment. This consideration of distribution in cost-benefit analysis is a contentious issue among economists.

There is a strong tradition that views distributional considerations as outside the proper scope of cost-benefit analysis. This view is perhaps most explicitly presented by

Harberger, in his famous article, "The Three Postulates of Applied Welfare Economics: An Interpretive Essay." [21] The third postulate states:

> when evaluating the net benefits or costs of a given action (project, program or policy), the costs and benefits accruing to each member of the relevant group (e.g. a nation) should normally be added without regard to the individual(s) to whom they accrue.

Harberger's argument for ignoring distributional considerations is based less on logic than tradition and pragmatism. He claims:

> The three basis postulates ... provide a de minimus answer to this need: their simplicity, their robustness and the long tradition that they represent all argue for them as the most probable common denominator on which a professional consensus on procedures for applied welfare economics can be based.

According to Harberger, economists are no more (or less) qualified than anyone else to make distributional value judgments. This point seems to confuse the issue, however. Economists would unanimously agree that the normative issue of a desirable income distribution is a societal question. However, economists are the best qualified to estimate the distributional impact of public investment. Thus, while economists should not impose their own judgments, they should help policymakers formalize their distributional goals.

Walter Hettich [23] and others have argued that there is no theoretical basis for ignoring distributional issues in cost-benefit analysis. Harberger implicitly assumes that the marginal utility of income is the same for all individuals. This is a difficult assumption to swallow in a model based on individualism

and consumer sovereignty.

Harberger has also argued that the distributional impact of a given public project is usually so small compared to the income level of affected people that such distributional consequences can be ignored without altering the cost-benefit analysis. But Hettich insists the analyst cannot, on a priori grounds, make this assumption. Moreover, it seems obviously false in the analysis of large-scale infrastructure projects in developing countries. Such an assumption requires prior empirical analysis.

Thus the Kaldor-Hicks criterion, because it considers only potential welfare gains, ignores the distributional effect of projects. If compensation is not paid, then, unless decision makers value gains (losses) to all individuals as equally (un)desirable, a project that satisfies the potential Pareto improvement criterion might not be a socially preferred outcome. Of course if income transfers were costless, then the implicit distributional weights of the potential Pareto improvement criterion would be acceptable. Robin Boadway has pointed out the difficulty (i.e. cost) of carrying out compensation. As a result, he claims, the same public investment project with and without compensation should be analyzed as two separate projects. Just, Hueth and Schmitz agree with this view but, appropriately, see it as a distributional issue subject to normative judgements. They state:

> ...one of the problems with the principle is that it is

based on potential rather than actual gains. Thus, in any policy context, the payment of compensation is a matter that must be decided by policy makers endowed with the authority to determine income distributional issues.[5]

A final limitation of the Kaldor-Hicks criterion, relevant to all the compensation criteria as well as the conception of the social welfare function by Bergson and Samuelson, is its inclusion of <u>individuals' valuations</u> exclusively. There are cases where government decisions override individuals' valuations. The concept of merit goods (or bads) is an attempt to deal theoretically with this phenomenon. Examples of such a case are mandatory education until age 16 and outlawing the use of certain narcotics. While perhaps these laws would be unacceptable under the Kaldor-Hicks criterion, such a cost-benefit analysis has not been performed due to the simple imposition by society of such "consumption patterns." The decriminalization of marijuana in some states is an example that even paternalistic social values change over time.

Despite the limitations of the Hicks-Kaldor criterion, it has become the starting point for cost-benefit analysis. This is largely due to its conceptual simplicity, its link to willingness-to-pay measures of individual welfare change and, perhaps most important, the lack of a viable alternative. The social welfare function, of which the Kaldor-Hicks criterion could be considered a particular form, simply was never developed into a useful tool of applied analysis.

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Chapter 3

BENEFIT AND COST MODELS

John D. Worrall*

Benefit-cost analysis of the Federal/State Vocational Rehabilitation (VR) program has become a virtual cottage industry. There have been dozens of such studies in the last two decades. A handful of these have appeared in the economics literature and, with the remainder, have served as inputs in the management information systems and public policy decision making sets of program directors and legislative bodies. The goals of these studies, as well as the sophistication of their designs have differed markedly. In this paper we shall consider the generic problem of attempting to determine (a) the impact of a treatment or treatment effects on future wages in the face of a nonexperimental design and, (b) some of the measurement problems specific to the vocational rehabilitation program. Although the former is exceedingly difficult, the latter may be even more problematic. We shall examine the implicit designs of some of the studies of the Federal/State programs, and contrast them with the methods that have been recommended or applied in the evaluation of other remedial manpower programs. The studies chosen for analysis highlight <u>some</u> of the difficulties in this type of research.

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The Impact of a Treatment (VR) on Future Wages

Consider a group that enters a rehabilitation program at some time (0). Assume that there are J people in the group. We observe the wages of that group at time (0) and again at some fixed point in time, (0 + k), after the application of the treatment. a) Suppose the wage of the ith individual at time (0 + k) is greater than at (0), can we deduce that the exposure to the VR program caused a wage gain? b) Or, if the sum

(1) $$W^T_{i0+k} > W^T_{i0}$$

(2) $$\sum_{i=1}^{J} W^T_{i0+k} > \sum_{i=1}^{J} W^T_{i0}$$

of the differences between wages at closure (0 + k) and at opening (0) is positive, can we be reasonably certain that exposure to the treatment caused the wage gain? Obviously there are a host of reasons why we cannot. For example, the wages of the group may have grown over time without the application of treatment.

Suppose we attempt to guard against this obvious threat to validity by examining the wages of another group of size J that was not exposed to the treatment. We might contrast the wages of the treatment group at time (0 + k) (W^T_{0+k}) with the wages of the comparison group at the same point in time (W^c_{0+k}). If we

(3) $$\sum_{i=1}^{J} W^T_{i0+k} > \sum_{i=1}^{J} W^c_{i0+k}$$

we still could not be certain that the treatment caused higher wages. It may be the case that the wages of the treatment group

(W_0^T) at time (0) were greater than those of the comparison group (W_0^C) at the same point in time. We might postulate that the wages of the comparison group were lower than those of the treatment groups at time (0) and (0 + k) because of some unchanging characteristic of both groups. Perhaps, we could control for this unchanging characteristic (fixed effect) as well as for the effect of the passage of time with some differencing technique,

$$(4) \qquad \sum_{i=1}^{J}(W_{i0+k}^T - W_{i0}^T) - \sum_{i=1}^{J}(W_{i0+k}^C - W_{i0}^C)$$

such as that given in (4), where the difference in differences might be attributed to the treatment effect. The choice of (2), (3) or (4) as an estimate of wage gain reflects the researcher's belief about the nature of the treatment and comparison groups' decision to participate in the VR program,[1] and the time path of wages.

Random Assignment

If eligible applicants for VR services were randomly assigned to a treatment group (T) or a control group (C), then the decision to participate would truly be controlled and the two groups could be considered homogeneous. The wage gain, if any, estimated by (3) above would serve as the true measure of treatment effect at time (0 + k).[2] In such a researcher's paradise, it would appear that all of our measurement problems would be solved.

Although random assignment, and hence participation, is the ideal, access to social service programs in general, and the VR programs in particular, is not granted on the basis of the desires of program evaluators. Denial of service on such bases might be immoral and unethical. We suggest some "moral" designs below, but first we shall consider some potential problems with measurement even with random assignment.

The population served by the VR program is a young one. It is not unusual to find a rehabilitant in her twenties who leaves the program at time (0 + k). She may have a life expectancy of more than fifty years, the bulk of which she may choose to spend in the labor force. Suppose her wage is typical of the rest of her treatment group and we can use it as the mean of the other J-1 subjects. If her wage at time (0 + k), ($\bar{W}^{T}_{0+k}$) exceeds that of the mean of the control ($\bar{W}^{C}_{0+k}$), we still do not know if or how long the effect of the treatment will last. Our data is right censored. The time paths of W^{T} and W^{C} may converge, diverge, or continue along parallel paths. (See Figure 1.)[3] In Figure 1, we use t* as the end of the treatment period and (0 + k) as the time at which group wage differences are measured. In many studies of the VR program, the elapsed time from the end of treatment to the time of measurement of the wage gap (0 + k) - (t*) is either sixty (recent studies) or 30 days (older studies). Suppose we assume that the wage gain will remain constant from (0 + k) to (0 + r) where r is the date of retirement. How do we

value the aggregate wage gain over this time period? What interest rate do we use to discount this gain to present value? We do not know with perfect certainty.

We might also question whether the control group had been contaminated (See ORR, 1983) by exposure to the agency (VR) administering the treatment. We shall return to these and related issues below.

Moral Designs

Although services currently are not denied on a random basis, clients who are found eligible for VR services can be randomly assigned to different treatments, and the efficacy of the VR program can be analyzed. Clients could be assigned to the treatments by a disinterested third party or university with "no axe to grind." Treatment groups might consist of:

Group 1 = Federal/State Program

2 = Private rehabilitation practices

3 = Voucher tied to purchase of rehabilitation services

4 = Cash payment equal to an estimate of the value of foregone services.

If those in group 4 received a cash payment of $10,000 each, and were not permitted to participate in the VR program, they would provide a measure of a pure income effect.

Although such a design would provide a rudimentary measure

of the relative efficiency of the VR program, many problems in addition to the time path of wages measurement problem would remain. The gains from the program are not limited to the pecuniary ones. Researchers have not been successful in measuring psychic gains from the program (see Cardus, Fuhrer, and Thrall; 1982). A design that allowed those eligible for services to purchase them would yield the rehabilitation client's evaluation of the monetary equivalent of the pecuniary and nonpecuniary gain associated with the program.

If group 4 were given the cash equivalent of foregone services and denied service, a fifth group could be given the same payment and given no instruction about what to do with their cash award. Subjects in different, randomly chosen, areas could be presented with price schedules for various rehabilitation services that are designed to derive demand schedules for such services. The cost of this design would be miniscule in comparison with the cost of the Income Maintenance Experiments or the billions of dollars that have been spent in the Federal/State VR program since its inception.

It is not clear that denial of services on a random basis need be immoral. It has never been established, in any scientific sense, that the VR program is cost-beneficial, or that the individuals who participate in the program actually have their productivity (and wages), health status, or net utility

increased by program participation. There is evidence that the program is cost-beneficial, in an intuitive sense, from the perspective of program participants. Millions of people with work disabilities have revealed their preference by program participation. Their expected utility gains outweighed the opportunity cost of their time. Society, in some loose sense, has also revealed its preference, through its elected representatives and their changing levels of program support over time.[4]

Recently, real levels of program support have begun to decline. The continued pressure for cuts in social welfare programs is not likely to lead to a decline in the number of attempts to arrive at a "number" with which to categorize our largest remedial manpower program.

NON RANDOM ASSIGNMENT

Much of the research that has been done has attempted to determine an absolute benefit-cost ratio for the VR program. The program evaluators have never had the luxury of a randomly assigned treatment and control group, hence, they have had to resort to nonexperimental designs in their attempts to fashion comparison (or quasi-control) groups. Some of these quasi-controls have been quite crude when gauged against the potential threats to internal and external validity.

We shall follow Bassi (RESTAT, Feb 84, 66(1), pp 36-43) and LaLonde (1984) and set out a simple taxonomy of estimates of

treatment effects, specification and assumptions. We shall consider the principal findings of LaLonde's comparison of these estimators with known treatment effects, Bassi's suggested statistical tests and findings, and Long, Mallar, and Thorton's (1981) application of one of the techniques to an evaluation of the JOB Corps. Our problem is to estimate <u>one</u> of the benefit components in a benefit-cost analysis of the VR program, wage gain. Our primary difficulty is that we do not know if program participation is random. Rehabilitation clients may differ in both observed and unobserved characteristics. Program participation may vary systemmatically with these characteristics. Such characteristics may be fixed or may change over time. The specification that we choose will affect the properties of our estimators.

LaLonde has demonstrated that most of the specifications considered below provide poor estimates of the treatment effect, especially for males, of the National Supported Work Demonstration. Nonexperimental methods generally understated the value of the treatment effect for males, frequently producing negative estimates of wage gain, when the wage gain was actually positive.[5] The nonexperimental methods provided more accurate estimates of the treatment effect for women, but the range was quite wide depending upon the comparison group, and the earnings and participation specification chosen.[6] We turn to

LaLonde's model of earnings and participation.

Suppose we hypothesize that an individual's earnings at time t depend upon whether that individual received vocational rehabilitation services (V_{it}) at time j, and a set of exogenous characteristics (X_{1it}). We could specify this earnings equation as:

(5) $$Y_{it} = \beta_1 X_{1it} + \delta V_{it} + \varepsilon_i + \varepsilon_t + \varepsilon_{it}$$

where is an individual fixed effect

is a time specific effect

and is a serially correlated error, with

(6) $$\varepsilon_{it} - \rho\varepsilon_{it-1} = \nu_{it},\ E(\nu_{it}) = E(\nu_{is}\ \nu_{it}) = 0, \text{ and } E(\nu_{it}^2) = \sigma^2$$

and ~~s denotes pretreatment~~ time.

Suppose that we further hypothesize that participation in the VR program is a function of a set of exogenous variables, X_{2it}, and current and past income. We could specify the participation equation as:

(7) $$V_{it} = \beta_2 X_{2it} + \lambda_0 Y_{it} + \ldots + \lambda_g Y_{it-g} + \gamma + \eta_{it}$$

where γ is an individual fixed effect,

and η_{it} is a serially uncorrelated error with

$$E(\eta_{it}) = E(\eta_{is}, \eta_{it}) = 0,\ E(\varepsilon_{it}\ \eta_{it}) = 0.$$

(8) If $v_{is} \leq \underline{v}$, $V_{it=1}$ for $t \geq j$, and $V_{it=0}$ for $t \leq j$.

If $v_{is} \geq \underline{v}$, $V_{it=0}$ for all t.

Both LaLonde (p.16-17) and Bassi (p. 37) assume either the

a[illegible]ence of serial correlation or a first order autoregressive scheme. LaLonde makes explicit the assumption that η_{it} and v_{it} are uncorrelated for the cases he considers. Bassi warns her readers that the first order autoregressive scheme may be too simple to capture the unobservables. Finally, LaLonde notes that X_{1it} or a subset may be in X_{2it}, and that the participation variable is probably a reflection of supply and demand interaction.[8]

Aggregate and Individual Data

The need for aggregate or individual data for the measurement of wage gain, and for a VR benefit-cost analysis, depends upon the structure given in 5-8 above. Any attempts to estimate the treatment effect with econometric techniques, given nonrandom program participation require individual client and control observations, such as those provided by the SSA-RSA data link.

Many of the earliest studies of the VR program adopted the estimator given in 2 above. They assumed that program participation was random, or that if it were nonrandom it was a function of an individual fixed effect - i.e. an individual specific unchanging component of the error term. Rewriting 2, for convenience, in terms of earnings and dividing by J, will yield

$$(2') \qquad \bar{Y}^{T}_{t} - \bar{Y}^{T}_{j-1}$$

as the estimate of earnings gain attributable to the program given the assumptions above. The Federal Board for Vocational Education adopted this estimator in its 1926 Annual Report with the further assumption that $\bar{Y}^T_{j-1}$ and the social rate of discount were zero. This, however, was followed rapidly by federal evaluations that not only attempted to control for $\bar{Y}^T_{j-1}$, but also were concerned with the time path of wages.

The Federal Board's 1931 Annual Report measured the earnings change from opening (1920-1924) to the 1927-1931 period. The Board did not assume that Y^T_{j-1} was zero and they examined changes in unemployment over time. This measurement of wage gain for specific individuals over such a long period of time has not been matched, and their mapping the time paths of individual earnings was unmatched until the SSA-RSA data link studies of the 1970's. Although the 1931 Annual Report[9] showed insight into the problem of the time path of wages and attempted to control for fixed effects, it did not allow for an aggregate time effect.

It still implicity adopted (2). If the board had extended its concern with the time path of wages to a comparison group and allowed earnings to be a function of an aggregate time component, they would have had (4) as their estimate of the program's effect.[10]

Rewriting (4) for convenience, with the necessary

aggregations and divisions will yield

$$(4') \quad (\overline{Y}^T_t - \overline{Y}^T_{j-1}) - (\overline{Y}^c_t - \overline{Y}^c_{j-1})$$

the difference in differences (see LaLonde, p.18) that, together with more elaborate specifications, has been the basic model of more recent Benefit-Cost studies of the VR program. These efforts have been ad hoc attempts to get estimators in the (4 ') family. Typically, as a control group is not available, investigators will attempt to adjust the stream to net out .

The work of Ronald W. Conley (1965,1969) has served as the basis for most of the VR Benefit-Cost studies of the last several decades. The most sophisticated extensions are currently being used to evaluate various state VR programs. Perhaps, the most widely used extension of Conley's model applied to aggregate data, is the Berkeley Planning Associaes (BPA) model developed by Frederick C. Collignon and his associates.[11] The BPA model reduces the stream by adjusting wages at opening by one-third to reflect transitory low wage effects and then reduces the benefit attributable to the program by 20 percent to capture a portion of the change in earnings streams that was not caused by the program. The earnings stream is projected using age-earnings profiles constructed from Census data. Gains attributed to the program are also subject to a decay function. The BPA model is used to estimate a benefit-cost ratio for the entire program as well as for various aggregate subgroups. Numerous adjustments are made to the benefit and cost estimates, in order to provide

realistic estimates, and the adjustments are subjected to sensitivity analysis.

Cardus, Furher and Thrall (CFT, 1982) adopt the BPA model's methodology for estimating the monetary portion of benefits and costs of the VR program. However, (CFT) propose the more ambitious analysis of all benefits-monetary and nonmonetary. They point out that those who receive the VR treatment may have improved physiological, psychological and interpersonal functioning (BEN 2); and that the program may promote independent living (BEN 3), as examples of nonmonetary benefits. They propose measuring BEN 2 from the change in a group of items on the Minnesota Functional Assessment Inventory (FAI) and BEN 3 with the Life Functional Index (LFI). If BEN 1 is the monetary benefit of VR, they want to map the net benefit flow from BEN 1, 2 & 3 into a single number (see CFT, 1982, pp. 11, 15-17; and CFT, 1980, pp. 29-41, 63-71). CFT suggest using the program manager's value judgments to determine the weights necessary to map the net benefit vector into the single value number.

Bellante (1972) used individual observations from R300 tapes to compute earnings gains. He regressed these earnings gains on a set of socio-economic variables in order to produce estimates of stratified benefits. Worrall (1978) used a similar method to arrive at stratified benefit-cost ratios. Worrall used a crude method in an attempt to construct a quasi-comparison group and

control for time effects. He used the mean wages of all those who had wages before the VR treatment and were either accepted or rejected for treatment. He estimated that mean wages were one quarter higher than median wages. He used the mean wages to construct cross section age earnings profiles, controlling for eduction, sex, race and disabling condition. Using a method introduced by Becker (1964) and applied by Conley (1969), Worrall dynamized these cross section pretreatment age-earnings profiles. Worrall followed the same procedure to construct post treatment age-earnings profiles. However, he used median wages to adjust the post treatment flows to further reduce gains attributable to the program. He regressed the difference in the present value or the earnings streams on a set of socio-economic variables to retrieve estimated benefit variables for stratified benefit-cost ratios.

Each of the studies of the VR program discussed above was hampered by its lack of a control group. Methodologically, all were seriously flawed. The BPA studies and Worrall paper, for example, all but explicitly stated the belief that the program participation decision and earnings function were related through both fixed effects and transitory components of income. The BPA group offered the transitory income components explanation as part of the rationale for adjusting wages at opening. Without control groups and micro data, neither the BPA nor the Worrall paper could have instrumented the VR participation variable, or

controlled for it through elaboration of specifications in the (4) family. LaLonde reviews these specifications, so we shall be brief in our discussion of them here.

With individual observations on both a treatment and comparison group, (4) can be specified as

(4A) $$Y_{it} - Y_{is} = \delta V_{it} + \beta_1(X_{1it} - X_{1is}) + (\epsilon_{it} - \epsilon_{is})$$

This specification allows for the fixed effect and its negative correlation with V , as well as an aggregate time effect and changes in exogenous characteristics between the pre and post treatment period. Unrestricted versions of (4A), such as

(4B) $$Y_{it} = \delta V_{it} + \beta_1 X_{1it} + R_1 X_{2is} + B_3 Y_{is} + \epsilon_{it}$$ or

(4C) $$Y_{it} = \delta V_{it} + \beta_1 X_{1it} + B_3 Y_{is} + \epsilon_{it}$$

can also be estimated. Choosing (4B) allows for the impact of a transitory component of income on participation, and (4C) extends this to control for the impact of exogenous factors in the program participation decision. LaLonde has demonstrated that consistent estimates can be retrieved with (4B) and (4C). (See LaLonde pp. 22-30). LaLonde has also demonstrated that consistent estimates of the treatment effect can be retrieved from the reduced form (4D), or with instrumentation of the treatment variable. from structure (4E).

(4D) $$Y_{it} = \delta V_{it} + \beta_1 X_{1it} + R_1 X_{2is} + B_3 Y_{is} + \epsilon_{it}$$

(4E) $$Y_{it} = \delta \hat{V}_{it} + \beta_1 X_{1it} + \epsilon_{it}$$

There has been one study of the treatment effect of the VR

program that had individual data on the treatment and comparison groups.

The Rutgers University Bureau of Economic Research drew a random sample of those who were referred to or applied for services but did not receive such services. The sampling frame was the New Jersey Federal-State R300 tape of 1975 fiscal year case service records. The Bureau hired rehabilitation counselors, who were employed by the New Jersey program, to interview the sample of those who did not receive services. All interviews were conducted after the counselors normal working hours.

Nowak (1983) used the Rutgers' interview results, the Survey of Health and Work Adjustment, to form a comparison group to contrast with a treatment group drawn from a random sample of New Jersey clients who received services and were closed in FY 1975. To estimate the treatment effect, she estimated the parameters of

$$(9) \qquad Y_{it} - Y_{is} = \delta V_{it} + \beta_1 X_{1it} + (\epsilon_{it} - \epsilon_{is}).$$

This attempt to estimate the effect of the VR program represented an improvement over earlier studies, but even this specification can lead to both biased and inconsistent parameter estimates, if the error structure and participation decision assumption is incorrect.

If Nowak believed that participation was random after controlling for a set of exogenous characteristics, she could have simply regressed Y_{it} on V_{it}, X_{1it} and ϵ_{it}. If she believed

that there was a fixed effect, she could have used the specification given in (4A) above, and then only age need appear in the X vector. Suppose there are no higher order age effects and age is a good instrument for the change in age, then using Nowak's specification would be equivalent to estimating (4A), and the rest of the X vector should have no influence on the change in earnings. Nowak does not report joint F statistics, but does report individual t statistics. When she discounts earnings flows at 10 percent, two of her four age variables, and two of eleven of the other variables in X are significant. With a 5 percent discount rate, three of the age dummies, and only one of the remaining eleven dummies are significant. Nowak does not believe that the participation decision is random (see Nowak, p. 23); however, she did not attempt to estimate the specifications given in (4B) to (4E), although data were available for some tests.

The Survey of Health and Work Adjustment did not have information on at least one key variable, disabling condition. Consequently, Nowak omitted this variable from her treatment effect runs, and probability of successful program completion regressions.[12] Worrall (1978), using maximum likelihood techniques, found a significant relationship between 7 of the 11 disability conditions he studied, and successful completion of the program. If the participation decision varies systematically

with the disability condition, and there are transitory income effects, estimation of specification (4C), (4D) or (4E) with data from the Survey of Health and Work Adjustment may not be possible without the disability condition variables.

Worrall (1976) also tested the hypothesis that application for VR treatment varied systematically with disabling condition. He found that 7 of the 11 disabling condition variables were significant in a probit analysis of the probability of application for VR services. In general, he found that the incremental probability of application varied directly with expected wage gain. His right hand side variables, with the exception of the disability conditions, were nearly identical with those Nowak used in her 1983 study.

Bassi (1984) suggests that the fixed effects model (4A) above is not likely to hold for the CETA program. Her observation can readily be extrapolated to the Vocational Rehabilitation program. She pointed out that there may be self selection into the CETA program on the basis of nonconstant unobservables, for example failing health. Or there may be creaming, as administrators have incentive to select those with negative transitory error terms (see Bassi, p. 37). Worrall and Berkowitz (1975) have found that the probability of acceptance into the VR program varies systematically with age, the unemployment rate, referral source, and disabling condition. Nine of eleven disability variables were significant in their

probability of acceptance runs. Given this kind of evidence, it is difficult to believe that participation is random.

Bassi (1984) suggests a hierachy of tests to be used when estimating treatment effects in the face of non-random selection. She recommends starting with the estimation of

$$(10) \qquad Y_{is} = X_{is}\beta + V_{it}\beta_s + u_{is}$$

with β_s providing a test of the correlation between participation and the error term, and a Chow test providing a test of earnings function structure. If these pre-program random effects tests are passed, i.e. $\beta_s = 0$ and the treatment and comparison groups' earnings function is the same in the absence of the treatment, then the VR treatment effect could be estimated with a random effects model. Simply estimating (5) with OLS would yield maximum likelihood estimates (see Bassi, p. 38). If the tests are failed, a fixed effects model might be appropriate.

Bassi then applied the same tests to a fixed effects model. She conducted her error and structure tests with the base year one year prior to training and with the base year two years prior to training. This provided her with information on "creaming". If, as she found with her minority women sample, the error and structure tests can be rejected with a base period one year prior to training but cannot be rejected with the base period two years prior to training, there is reason to suspect creaming.[13]

Bassi integrated a first order auto-regressive scheme into

the fixed effects model (4A above), and illustrated a recursive scheme for retrieving point estimates of the treatment effect when "creaming" is present. The tests of homogeneous earnings function and common structure are also applied to this specification.

Long, Mallar, and Thorton (1981) retrieved structural estimates of the effect of Job Corp treatment on earnings. (See specification 4E above). They chose their comparison group in a fashion that enabled them to identify the participation decision. They began by attempting to limit treatment contamination. They eliminated geographic areas that were near treatment centers or where program publicity, outreach and recruitment were strong. They then matched the characteristics of program sites and comparison sites, and drew a random sample of the comparison sites. Finally, they selected a sample of individuals who were similar to program participants, but who had never applied to the program.[14] They were able to use distance from the treatment centers, knowledge of the program and access to publicity to identify the participation decision.

<u>Social Security Administration-Rehabilition Services Administration Data Link: Suggested Models of Treatment Measurement</u>

The SSA-RSA Data Link provided the data that would have enabled estimation of models in the (4') family above. Unfortunately, such estimation was not undertaken, the data link

has been discontinued, and the data link computer tapes are not available. We shall briefly review the data link studies and suggest how the data link could be re-instituted and applied to systematic VR program evaluation.

The R-300 Case Service Records of those who were closed in Fiscal Year (FY) 1971 were matched with the Social Security Administration's Earnings Summary Record (ESR) and Master Beneficiary Record (MBR). The Rehabilitation Service Administration (RSA) provided SSA with a computer tape containing 756,716 FY 1971 records. SSA was able to match 639,900 of these to the MBR and ESR. Of those VR clients' whose records were matched, 34 percent had completed the program successfully (closure status 26), 11.5 percent had been accepted for services but had not successfully completed the program (closure statuses 28 and 30), and 50.6 percent had not been accepted for services (closure statuses 00-08).[15] The ESR provided the history of wages and self-employment income reported to SSA, and the MBR provided a monthly record of cash benefits paid under the Old Age, Survivors, and Disability Insurance program (OASDI).

The data-link was used to contrast the wages and employment percentages of successful closures, nonsuccessful closures and those not accepted for services. This research effort is summarized in two excellent articles by Joseph Greenblum (1977, 1979). SSA and RSA realized that the participation decision

might not be random (see Greenblum, 1977), but the participation decision was not explicitly modelled. Instead the main focus of the analysis was shifted to comparisons of successful and nonsuccessful closures, on the assumption that since both of these groups were participants this would provide a control. This method may provide a partial control, but both groups have received the treatment, albeit with different intensities.

Some of the "nonsuccesses" may have received the full treatment and not been employed when their cases were closed. If they found employment subsequent to closure, no benefit would have been attributed to the treatment. In the data-link studies the earnings from the year before referral, which varied for individuals, through 1972 the year after closure, were used. RSA defined successful program completion as having been employed for 30 days or more.[16]

Greenblum realized that there were factors, some exogenous, that would affect the level of wages. He assumed that these factors were not as likely to affect the probability of employment. Consequently, not only were the level of wages of rehabilitation clients contrasted, but the percentages employed were also. Greenblum (1979) also provided cross section age-earnings profiles by sex-race-education and by disability condition for both successful and nonsuccessful VR clients, as well as those not accepted for services. Although interaction affects were considered in the data-link studies, no full

multivariate analysis was undertaken.

IRS Confidentiality and Program Evaluation

A new data-link would provide the data necessary to estimate models (4) through (4E), and to conduct the tests suggested by Bassi. However, SSA earnings records are subject to the confidentiality requirements of the United States Internal Revenue Service. These confidentiality requirements are designed to prevent the identification of any individual taxpayer. Models such as (4C), (4D) and (4E) require a full vector of X variables. Consider that the X vector might contain age, race, sex, education, marital status, family size, disability condition code, referral source, and the presence of severe or multiple disabilities. If these variables were cast as polytomies and an investigator were parsimonious, with 6 age, 2 race, 2 sex, 5 education, 2 marital status, 3 family size, 11 disability conditions, and 5 referral source categories, there would be 39,600 distinct combinations of these variables. Even at the national level, it would be highly likely that individual clients could be identified.[17] Individual state program evaluation by non-social security investigators would clearly violate IRS confidentiality requirements. However, estimation of fixed effects models such as (4A) and (4B) require only a few variables, and are not likely to result in violations of the IRS confidentiality requirements.

Estimation of (4A) and its elaborators and their related tests suggested by Bassi (1984) would require just age and disability variables. For aggregate evaluation of the program, the age variable alone would suffice. The disability variables would enable benefit-cost ratios to be derived by disability group. Estimation of model (4B), which allows for both fixed effects and <u>transitory</u> error effects, requires no data on exogenous variables (other than the treatment) for an aggregate program evaluation. Provision of the age and disability variables would allow for stratified benefit-cost analysis.

In order to apply Bassi's test, the earnings data provided by the new Data-Link would have to be provided for a period beginning at least 3 periods prior to referral.[18] In addition, although few VR clients will exceed the earnings limits for the payment of Social Security taxes, if the earnings streams were provided on a quarterly basis, maximum likelihood techniques could be used to provide earnings estimates for the entire year.

Use of information from a data-link may obviate some of the problems in estimating the VR treatment effect; however, many problems and questions remain. We conclude with some of these.

<u>Some Problems and Questions</u>

We have seen that the data-link would allow us to apply econometric techniques to consider individual fixed effects, aggregate time effects and transitory income effects. We can also test for the appropriateness of the models that we are

using. However, the research of LaLonde should convince us that the application of these techniques is not foolproof. He found that they did not necessarily provide a good measure of the treatment effect. Bassi found that none of the models we could estimate without violating the confidentiality requirements was appropriate for an evaluation of the CETA treatment effect in white males. Although La Londe's results with the National Supported Work treatment and Bassi's findings with her CETA treatment need not be generalizable, they should give us pause.

Nowak has come the closest to applying the method we recommend. She computed benefit-cost ratios using some of variable cost only. Casual observation suggests that if her denominators were leveraged to reflect the full cost of the treatment (i.e. to arrive at average benefit cost ratios), the benefit-cost ratios could fall below one. Even if modern econometric methods indicated that the benefit, as measured by the earnings gain, did not exceed the cost, we could not demonstrate that the program is not cost beneficial from a social perspective. None of the methods suggested above provide for an estimation and valuation of full utility gains as a result of the treatment. Nonetheless, we should employ the methods suggested and contrast them with the estimates derived from the ad hoc methods employed by Conley, Bellante, Collignon and Worrall.

Full benefit-cost analysis of the VR system may not be.

ultimately, possible. We might consider turning to less ambitious program evaluation goals. Perhaps, we should examine the relative efficiency of the various state programs, examining what they achieved in the production of multiple outputs, e.g. earnings-employment-health, as compared with what they could have achieved if they had followed "best practice." The research of Cavin and Stafford (1985) on frontier production and cost functions and their application to an evaluation of the Employment Service (ES) provides the direction for such work.

Endnotes

1. We use the decision to participate as if it were a utility maximizing choice on the part of a person with a work disability. Actually, the process is far more complicated as it involves a helping professional's (the Program) decision to "accept" the "client" for services as well.

2. And we could apply the classical statistical tests of the difference in means of the two groups, calculate confidence intervals for the wage gains, etc.

3. Many subjects earn wages while receiving the rehabilitating "treatment". We show the "typical" age earnings profile in our figure, i.e. concave. LaLonde (1984) using the NSW data found wage gaps that decreased from t* to (0 + k).

4. We realize that for individuals participating in the program, expectations are frequently not met. Fully one third are not sucessfully closed, for example. Hence, we cannot use "participation" as proof that the program is cost-beneficial. Similarly, we cannot use the fact that a coalition of voters or legislators reveal their preference for a program as a proof of its cost-beneficiality without additional knowledge. (See Blair & Milberg, in this report).

5. The mean earnings gain measured from experimental data was $386 with a standard error of $476. (See LaLonde's Table 2-8,

p.45.) Hence, the 95% confidence interval includes zero (-$46 treatment effect $1,818). However, many of the estimators from the econometric techniques were large and negative. These nonexperimental estimates ranged from -$15,578 to $1,466 (See LaLonde's Table C.1, p. 68).

6. The mean earnings gain measured from experimental data for females was $851, with a standard error of $307 (See LaLonde's Table 1.8, p. 22). The 95% confidence interval for the treatment effect is ($246 treatment effect $1,456). Nonexperimental estimates of the treatment effect ranged from $3,575 to -$3,363 with 95% confidence intervals of ($3,023 treatment effect $4,130) and (-$3,993 treatment effect -$2,733), respectively. These confidence intervals have been derived from LaLonde's Table 1.8. The figure there for the highest estimate differs by $3 from that reported in his Table C.1.

7. We have changed the notation slightly. See LaLonde p.16.

8. Although the Arkansas R & T Center has done work on client-counselor interaction, we know of no benefit-cost analysis of the VR system that has modeled the applicant and gatekeeper side. The analysis usually proceeds with the implicit assumption of a utility maximizing process on the part of the applicant. Attempts to make this process explicit and to specify a model have been very sophisticated. See Crawford and Killingsworth (1984).

9. See Edward Berkowitz, "The Cost-Benefit Tradition in Vocational Rehabilitation." Berkowitz discusses this and other earlier efforts in his paper in our Report.

10. Our (3) above rewritten as (3') would be . Although (3') allows for the aggregate component, it assumes participation is random.

11. See Frederick C. Collignon, Richard B. Dodson, and Gloria Root (1977) for a clearer exposition of the model.

12. See Yatchew and Griliches (1985) for a discussion of specification error in Probit models.

13. See Bassi, p. 40 and Table. 1.

14. Mallar (1979) outlines the design, estimation technique, some econometric issues and results.

15. The remaining 3.9 percent were for clients whose closure status was unknown. See Greenblum, 1979, p. 37.

16. Crawford and Killingsworth (1984) suggest a model which takes advantage of information on the intensity of the treatment to measure the impact of the VR program.

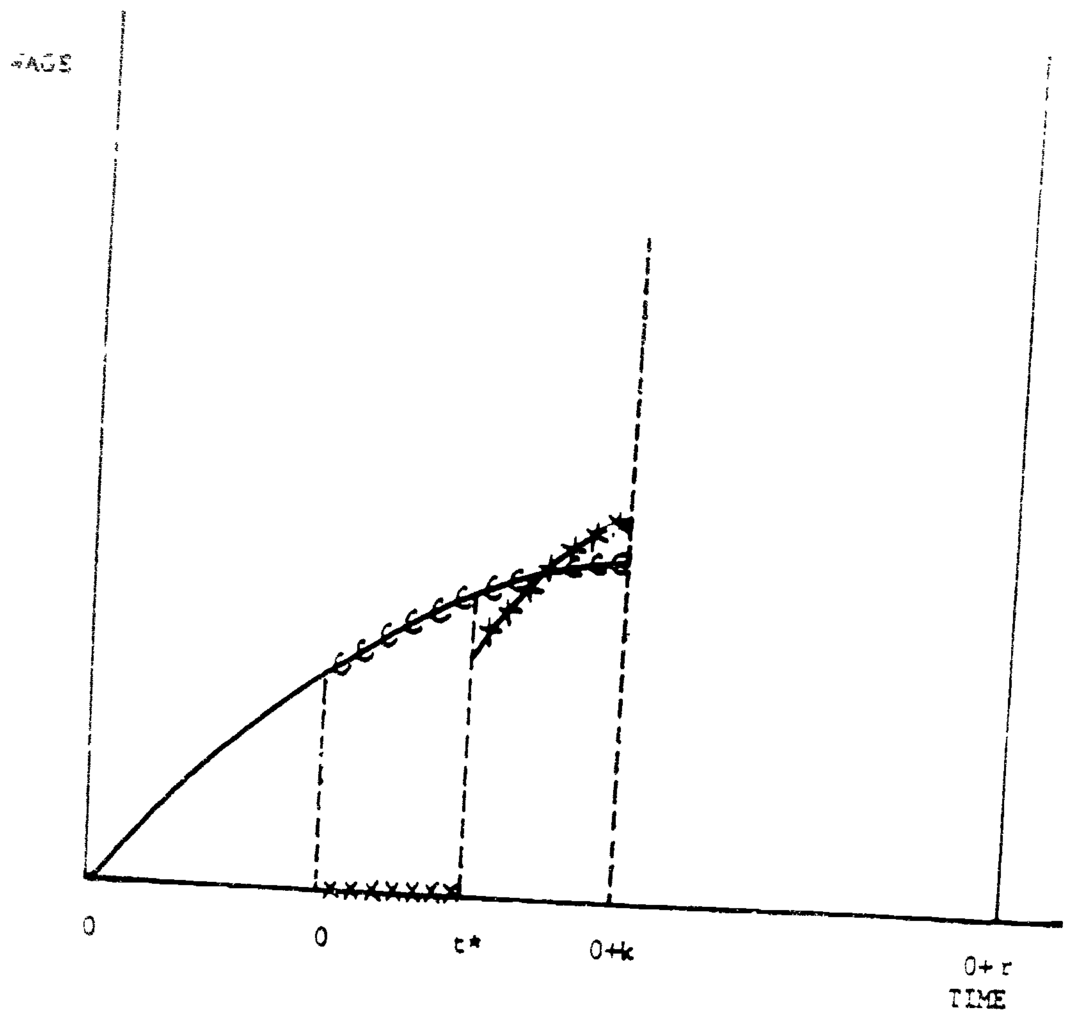
17. If we included a dummy variable for the state general program, we could have far more unique variable combinations than VR clients in any individual year.

18. Bassi used as an instrument for . to eliminate correlation with and in her fixed effects model with a first order auto-regressive scheme. It is crucial to have a good instrument to begin to solve her model recursively - See her

footnote number 9.

FIGURE 1

WAGE TIME PATHS



(solid curve)	= both treatment and control (equal by random assignment)
xxxxx	= treatment, assumed zero during the period of treatment
ccccc	= control, assumed to have an aggregated time effect
0	= beginning of treatment
t*	= end of treatment
0+k	= end of observation period
0+r	= retirement

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Chapter 4

A MODEL OF THE VR PROGRAM ON INDIVIDUAL BEHAVIOR

Duncan Mann*

This document develops a theoretical model of client participation and individual program design by a counselor in a state vocational rehabiliation (VR) program. The framework incorporates optimizing behavior by both client and counselor and provides a structure to facilitate the empirical analysis of client and counselor decisions. A context is provided within which the measurement of benefits and costs of a VR program can be better understood. To a large extent the discussion of client behavior builds upon unpublished work by Crawford and Killingsworth (Mimeo, October, 1983).

The benefits from a vocational rehabilitation program are varied and difficult to measure. They include the utility gains of individual clients, productivity gains to society, and possible external effects such as utility gains for relatives and friends of clients. These benefits result from VR program services which are designed to improve client health and job functioning skills. Improvements in health may directly increase a client's utility as well as increase earnings in the labor market, indirectly increasing utility through greater

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consumption. (See the discussion in Chapter 2 on when income changes can be construed as benefit dollars and added across individuals.) Other program services that improve a client's ability to function in a job may also increase earnings and, through consumption, utility.

Competitive labor markets can translate a client's productivity gains into a measureable wage or earnings. However, capturing the direct effect of health gains on client welfare or any external benefits is exceedingly difficult if not impossible. Improved health may be very important to one person and only moderately so to another. Thus, although quantitative measures of health gains for individuals may be deriveable from data, the value of these improvements is subjective and summing these valuations across individuals problematic. This issue is similar to the difficulties of using the sum of changes in consumers' surplus as an indicator of social welfare as discussed in Chapter 2.

The client population considered here includes individuals who satisfy two conditions; all have been accepted into the VR program and have a specific set of individualized program services, and each client has agreed to begin (and actually does begin) the program. Individuals accepted into the program but who have not received any program services for one reason or another constitute a "control group." This collection of

individuals provides a population with characteristics both observeable and unobserveable that closely approximate those of the client population. The benefits of program participation that arise from increased productivity or wage income can then be isolated by subtracting the wage gains of the control group from the wage gains of the client population.

It should be noted that such a control group is not the ideal since there is presumeably something that differentiates this group from the client population. If there is an unobserveable systematic difference between these two groups our measurement of benefits could be poor. However, individuals are identified with the control group for a variety of reasons, several of which are seemingly random events, for example, moving out of state. The data need to be analysed carefully for any suspected unobserveable differences.

The difficulties of extracting consistient, unbiased estimates of a "treatment effect" with non-random assignment, such as in a VR program are discussed in Chapter 3 where previous attempts to circumvent these problems are surveyed. Our approach here is evolutionary with respect to this issue in that we believe the control group identified is a distinct improvement over past studies.

program implies that the expected utility of participation is greater than the client's status quo position or reservation

utility level. Since a client does not bear the actual cost of program services this only ensures that the benefits of participation are positive.

A client's decision consists of how long to remain in the VR program. The client also agrees to the the particular type or intensity of services in their program. From a client's perspective there are both benefits and costs to remaining in the VR program. The benefits of continued participation include incremental gains to health and work skill levels. The opportunity cost of remaining in the VR program consists of higher wages that may be earned in the labor market compared to compensation within the VR program. This tradeoff can be formulated and analyzed as an optimal stopping problem.

The counselor's decisions include designing the substance or intensity of services provided to each of their clients and a determination of when a client should leave the program. The counselor must choose the best way to allocate limited agency resources to the client population. The counselor's objectives can be viewed as serving either humanitarian, social service goals or self-interested ones, or all of these.[1] Since both the counselor and the client decide when a particular individual should leave leave the VR program, the observed decision is the minimum of the client's and counselor's choice for length of program participation.

The next two sections analyse the client's and counselor's

optimization problems.

Client

Each client is assumed to have a utility function that depends on levels of consumption (c) and health (h). For simplicity, the utility a client enjoys at a point in time is assumed to take a particular form:

(1) $$U(c(t), h(t)) = bc(t) + g(h(t))$$

where t represents time, b is a positive number and g is an increasing function. Over a period of time, say from t_1 to t_2, utility can be represented as:

(2) $$\int_{t_1}^{t_2} \{bc(t) + g(h(t))\}\, e^{-qt} dt$$

where q is the client's discount factor.

At any time a client can purchase a level of consumption that is constrained by their current income[2]. Client's income may come from non-wage sources, I, as well as wage sources, w. Non-wage income is assumed to be fixed at a level I over time. While participating in the VR program a client is assumed to have a fixed level of "maintenance" income and thus consumption, $\bar{c}$. This fixed level of income and consumption is net of any direct expenses or indirect costs of participating in the program.

The benefits of participation in the VR program are described by changes in the "health" and "adaptability" status of individual clients. Better health is of direct interest to a client since it is an argument in their utility function. Individuals in good health are better able to enjoy what life has to offer. Health is also important to a client for its influence on earnings. The clear positive relationship between health and earnings is well documented in the literature.

Adaptability is here construed to mean basic skills necessary for functioning on a job. The level of a client's adaptability will influence their earnings when employed. A wage or earnings equation for an individual can be written as:

$$w(t) = \phi + \phi_a a(t) + \phi_h h(t). \tag{3}$$

We further suppose that the effect of the substance or intensity (s) and duration (d) of an individual client's program participation adaptability and health takes the form[3]:

$$a(t) = a_0 e^{(\gamma_a s_a - \delta_a)d}, \tag{4}$$
$$h(t) = h_0 e^{(\gamma_h s_h - \delta_h)d}.$$

The initial levels of health and adaptability are h_0 and a_0. Parameters γ_h and γ_a represent the rate at which a level of services translate into gains in health and adaptability. The parameters γ_h and δ_a are "depreciation" factors for health and

adaptability. Notice that it is assumed that different intensities of health and adaptability augmenting services may be received, s_h and s_a [4].

The client's problem is to choose the optimal time to leave the VR program:

$$
\begin{aligned}
(5)\quad \max_{d}\quad & \int_{o}^{d} \{bc(t) + g(h(t))\}\; e^{-qt}dt \\
+ & \int_{d}^{T} \{be(t) + g(h(t))\}\; e^{-qt}dt \\
\text{S.T.}\quad & c(t) \begin{cases} \bar{c} + I & t < d \\ I + w(t) & t \geq d \end{cases} \\
& w(t) = \phi + \phi_a a(t) + \phi_h h(t) \\
& h(t) = \begin{cases} h_0 e^{(\gamma_h s_h - \delta_h)t} & t < d \\ h_0 e^{(\gamma_h s_h d - \delta_h t)} & t \geq d \end{cases} \\
& a(t) = \begin{cases} a_0 e^{(\gamma_a s_a - \delta_a)t} & t < d \\ a_0 e^{(\gamma_a s_a d - \delta_a t)} & t \geq d \end{cases}
\end{aligned}
$$

All of the constraints can be substituted directly into the objective function to yield an unconstrained maximization problem. The necessary condition for an optimum is:

$$(6) \quad 0 = -\{b(I + \phi + \phi_h h_0 e^{(\gamma_h s_h - \delta_h)d} + \phi_a a_0 e^{(\gamma_a s_a - \delta_a)d} + g(h_0 e^{(\gamma_h s_h - \delta_h)d}\} e^{-qd}$$

$$+ \{b(I + \bar{c}) + g(h_0 e^{(\gamma_h s_h - \delta_h)d})\} e^{-qd}$$

$$+ \int_d^T \{b(\gamma_h s_h \phi_h h_0 e^{(\gamma_h s_h d - \delta_h t)} + s_a \phi_a a_0 e^{(\gamma_a s_a d - \delta_a t)})$$

$$+ g'\gamma_h s_h h_0 e^{\gamma_h s_h d - \delta_h t}\} e^{-qt} dt .$$

This expression simplifies to:

$$(7) \quad d = \frac{\log m(0) - \log \dfrac{b\gamma_h s_h \phi_h + g'\gamma_h s}{\delta_h + q} e^{(\gamma_h s_h - \delta_h)} + \dfrac{b\gamma_a \phi_a s_a a_0}{\delta_a + q} e^{(\gamma_a s_a - \delta_a)}}{1 - q}$$

where $m(0) = b\left[\phi + \phi_h h_0 + \phi_a a_0 - \bar{c}\right]$

is the "cost" of participating in the program at time zero. This simplification also assumes that the time horizon over which the client is concerned is sufficiently long that nothing is lost in equating T to infinity.

The first two terms in (6) represent the consumption losses due to the, presumably low, fixed compensation received while in the program compared to a market wage reflecting health and adaptability levels at time d. This "cost" could be negative, for example, a person with a recent severe injury may be virtually unemployable prior to receiving adequate rehabilitative services. The third term measures how incremental consumption and health gains from further participation affect future utility levels.

Counselors

Counselors must decide how to allocate a limited amount of rehabilitative services across the client population. Each counselor is assumed to have a fixed dollar level of services at their disposal (k). The number and type of clients each counselor deals with are also exogeneously given. The counselor's utility function is assumed to be monotonically increasing in the number of "successful" cases[5,6]. This effect on utility could result from increases in future compensation or less quantifiable gains associated with helping others or a combination of these.

A counselor can select the substance or intensity level of services related to health (s_h) and adaptability (s_a) for each client. The duration of participation (d') may also be determined for each client by a counselor[7]. These choices are assumed to be made at the start of a client's participation and are not modified through time. The probability that a particular client becomes a successful closure is assumed to be a function of the levels of health and adaptability they take to the labor market.

$$(8) \qquad \Pr(i = 1 \mid a_{0i}, h_{0i}, s_{ai}, s_{hi}, d_i') = \sigma + \sigma_h h_{0i} e^{(\eta_h s_i - \delta_h) d_i'} + \sigma_a a_{0i} e^{(\eta_a s_i - \delta_a) d_i'} \qquad i = 1 \ldots h$$

The counselor's budgetary constraint is:

(9) $$\sum_{i=1}^{n}(w_a s_{ai} + w_h s_{hi})d'_i \le \bar{k} .$$

The prices of adaptability and health related services are w_a and w_h, respectively. The objective function of a counselor can now be written as:

(10) $$\max_{s_{ai},\, s_{hi},\, d'_i} \sum_{i=1}^{n} \left(\sigma + \sigma_h h_{0i} e^{(\eta_h s_{ai} - \delta_h)} d'_i + \sigma_a a_{0i} e^{(\eta_a s_{ai} - \delta_a)} d'_i \right) \quad \text{S.T.} \quad \sum_{i=1}^{n}(w_a s_{ai} + w_h s_{hi})d'_i \le \bar{k} .$$

The first order conditions to this problem can be manipulated to yield a relation between the substance or intensity of health and adaptability services for an individual client:

(11) $$\frac{\eta_a \sigma_a a_{0i} e^{(\eta_a s_{ai} - \delta_a)}}{\eta_a \sigma_a h_{0i} e^{(\eta_h s_{hi} - \delta_h)}} = \frac{w_a}{w_h} .$$

This "efficiency" condition is interpreted as equating the ratio of productivity in adaptability and health services to the relative prices of those services. Notice that, other things equal, a reduction in a client's initial health (adaptability) status would be reflected in an increase in the intensity or substance of health (adaptability) services. Other comparative statics are easily obtained. This comparative static can be

identified directly from this relation because the first order conditions for s_{ai} and s_{hi} do not involve any of the other choice variables - in particular these conditions are independent of d_i.

The duration a counselor would choose for different clients satisfy the next relation, also derived from the first order conditions:

$$(12)\quad d_i' - d_j' = \log\{(\eta_h s_{hj} - \delta_h)\,\sigma_h h_{0j} e^{(\eta_h s_{hj} - \delta_h)} + (\eta_a s_{aj} - \delta_a)\,\sigma_a a_{0j} e^{(\eta_a s_{aj} - \delta_a)}\}$$
$$- \log\{(\eta_h s_{hi} - \delta_i)\,\sigma_h h_{0i} e^{(\eta_h s_{hi} - \delta_h)} + (\eta_a s_{ai} - \delta_a)\,\sigma_a a_{0i} e^{(\eta_a s_{ai} - \delta_a)}\}$$

This equation explains differences in length of program participation chosen by the counselor. The endogeneous selections of s_{ai} s_{aj} s_{hi} and s_{hj} as well as paramaters affect these duration choices. Other things being equal, clients with relatively lower levels of health and adaptability would be given longer periods of service.

The third equation that is of interest is the counselor's budget constraint which determines the absolute levels and durations of services received by clients.

The actual duration of program participation by a particular client is the minimum of the client's own choice, d_i and the counselor's choice d_i'.

Estimation of the various relations derived here will require further work and consideration of the econometric issues raised in Crawford and Killingsworth.

FOOTNOTES

1. Another area for research might consider the decisions regarding duration and substance or intensity that would be made bv a social planner maximizing a social welfare function. Mechanisms or incentive schemes that make client and counselor decisions congruent with a social planner could be investigated.

2. Borrowing is ruled out. This restriction could easily be relaxed, however it would seem appropriate to assume that individuals in a state VR program do not have significant income smoothing opportunities.

3. Simpler or more complicated functional relationships are possible for these as well as other of the effects described. These are manageable and captured the important elements of choice. They also (hopefully) yield some empirically testable results.

4. We may find it desirable to actually disaggregate the VR population into two groups. Preliminary discussion suggests that there may be a large group of individuals who receive primarily health related services and another group that receive mostly adaptability related services. Further analysis of the data and discussion of this issue is needed.

5. The definition of a "successful" case is arbitrary. Here it is assumed to coincide with 60 continuous days of employment.

6. Alternative goals such as maximizing the sum of clients' earnings increases yield similar results since earnings as well as successful cases are assumed to depend on levels of health and adaptability.

7. If the counselor can choose distinct lengths for health and adaptability services, d_h' and d_a', respectively, the expressions derived later relating choice variables to parameters are significantly simplified.

Chapter 5

THE R-300 DATA SET

Ernest Gibbs
Anita Hall-Kane*

The national R-300 data set for Fiscal Year 1982, provided by the Rehabilitation Services Administration (RSA), supplies the basic information pertaining to each individual closed from the rehabilitation program. This set contains data on each individual from the time he is initially referred to the program, through the possible acceptance into the program and on to closure from the program.

The information concerning each VR client is collected by 50 state agencies serving all eligible clients and 30 specialized agencies. In addition, there are reporting agencies such as Guam, Puerto Rico, Virgin Islands, Washington D. C. and Americam Samoa. In all, there is a grand total of 86 separate agencies.

R-300 Classification Codes

For fiscal year 1982, the national R-300 data set contains 720,612 individual observations. Table 5.1 is the record layout of all information available in the national R-300 data set together with a brief description of some of the variables

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Table 5.1
Tape Layout for R-300 Data
(FY 1982)

Position	Variable
1	"1" Card Number
2-3	Agency Code
4-13	Case Number
14-16	County Code
17-21	Zip Code
22-25	Referral Date
26-27	Referral Source
29-29	Age at Referral
30	Sex
31-33	Disability as Reported
34-42	Social Security Number
43	SSDI Status at Referral
44	SSI Status as Referral
45	Race
46-47	Months in Statuses 00-02
48	Spanish Origin
49	Reason Not Accepted
50	Outcome of Referral
51-53	Major Disabling Condition
54-56	Secondary Disabling Condition
57	Outcome of Previous Closure
58-59	Months Since Previous Closure
60	Marital Status
61	Number of Dependents
62	Number in Family
63-64	Highest Grade Completed
65	Work Status at Referral
66-68	Weekly Earnings at Referral
69	Family Income at Referral
70	Type of Public Assistance at Referral
71-73	Monthly Amount of Public Assistance at Referral
74	Time on Public Assistance at Referral
75-76	Source of Support at Referral
77-78	Type of Institution at Referral
79-80	Blank
81	"2" Card Number
82-83	Agency Code
84-93	Case Number
94-97	Date of Closure
98	SSA Status at Referral
99	SSA Claim Type
100-102	Federal Special Program Identification
103-107	Total Cost of Case Services
108-112	Cost of Rehab. Facilitites
113-117	Social Security Trust Funds
118-122	Supplemental Security Income Funds
123	SSDI Status at Closure
124	SSI Status at closure
125	Work Status at Closure
126-128	Weekly Earnings at Closure
129	Type of Public Assistance at Closure
130-132	Monthly Amounts of Public Assistance at Closure
133-135	Occupation at Closure
137-138	Months Spent in Status 06
139-140	Months Spent in Status 10-24
141-142	Months Spent in Status 18
143-144	Months Spent in Status 20-22
145	Outcome of EE/VR
146	Reason not Rehabilitated
147	Diagnostic Services Provided
148	Restorative Services Provided
149	College Training Provided
150	Other Academic Training Provided
151	Business Training Provided
152	Vocational School Training Provided
153	On-the-Job Training Provided
154	Adjustment Training Provided
155	Miscellaneous Training Provided
156	Maintenance Services Provided
157	Other Serives Provided
158	Family Member Services Provided
159-160	Blank

pertaining to benefit cost analysis. A further explanation of these variables and how they are used in benefit cost analysis is given below.

Closure Status

The observations on the R-300 data set represent closed cases from all 86 agencies in one or the other of these possible codes: 08, 26, 28, 30. Before an individual is accepted as an active case, that individual must be certified as meeting the three basic elgibility requirements for for VR services. These eligibility requirements are:

1) the presence of a physical or mental disability
2) the existence of a substantial handicap to employment
3) a finding that a reasonable expectation exists that vocational rehabiliation services may be of benefit in terms of employability.

There are four different closure statuses.

1. If an individual fails to meet these requirements he is closed in status 08. Closure status 08 signifies all persons not accepted for VR, whether closed from referral (status 00), closed from applicant status (status 02), or closed from extended evaluation (status 06).

2. Closure status 26 indicates a successfully rehabilitated client. The criterion for successful closure is employment for a minimum of 60 days, except for homemaker placements.

3. Closure status 28 indicates cases closed unsuccessfully, i.e. not rahabiltated after acceptance into the program but after receipt of services.

4. Closure status 30 indicates cases closed after acceptance for VR services, but before receipt of VR services.

Table 5.2 gives the frequency count of individuals in each closure status, together with some of the reasons why individuals were not accepted into the program. The explanations range from simply being unable to locate or contact the client, to the death of the client, or to the absence of any disabling condtitions.

Table 5.2
Distribution of the Outcome of Referral Process

Closure Status	Number of Clients	Percentage of Total Data Set
08	369,681	51.3%
26	215,569	30.0%
28	98,935	13.7%
30	36,427	5.0%
	720,612	100.0%

Of Those Closed as Status 00 or 02 The following is a Distribution of Reasons for Non-Acceptance:	Number of Clients	Percentage of Total
1) Unable to locate of contact, moved	35,532	27.8%
2) Handicap too severe or unfavorable medical prognosis	20,499	16.1%
3) Refused services or further services	31,638	24.8%
4) Death	3,543	2.8%
5) Client institutionalized	4,689	3.7%
6) Transfered to another agency	2,094	1.6%
7) Failure of cooperate	29,617	23.2%
8) No disabling condition	0	0%
9) No vocational handicap	0	0%
	127,612	100.0%

Age at Referral

The age of the client at referral is recorded as a continuous variable. Most clients are found to be 18 to 65 years of age with an average age at referral of 33 years of age. The distribution of ages at referral is given in Table 5.3. Age is an important variable when analyzing the benefits of VR because of the correlation between age and earnings. The relationship of earnings to age over time increases then at some point in time, flattens and begins to decrease. In chapter 7, we calculate these 'age-earnings profiles' to examine the relationship between age and earnings.

Table 5.3*
Distribution of Client Age at Referral

Age at Referral	Number of Clients	Percentage of Total Data Set
Ages 1 to 15	10,220	1.42%
Ages 16 to 25	252,955	35.10%
Ages 26 to 30	103,202	14.32%
Ages 31 to 35	85,242	11.83%
Ages 36 to 40	66,849	9.28%
Ages 41 & Over	196,269	27.24%
	714,737	99.19%

* Frequency counts for Tables 5.3 to 5.11 may not be equivalent to the total number of observations in the data set (N=720,612) due to information not reported by the client.

Client Gender

Table 5.4 gives the distribution of client by sex. Sex of a client is an important variable in determining benefits because

of the possible role it may play in the determination of wages. Also, many women are closed as unpaid homemakers and thus have zero wage at closure.

Table 5.4
Distribution of Client Gender

Gender	Number of Clients	Percentage of Total Data Set
Male	416,715	57.83%
Female	289,796	40.22%
	706,511	98.05%

Client Race

The client's race may a significant bearing on the probability of success in the VR program and on the benefits attributable to the VR program. Traditionally, because of better labor conditions, whites will have higher benefits than nonwhites. In chapter 7, in the benefit cost analysis, we compare benefit and costs for only the white and black racial groups, since most of the clients fall into one of these two classifications. In Table 5.5 the distribution of client race is given.

Table 5.5
Distribution of Client Race

Racial Identity	Number of Clients	Percentage of Total Data Set
White	519,962	72.61%
Black	138,236	19.18%
Indian	4,645	.64%
Others (Oriental, etc.)	9,757	1.35%
	672,600	93.33%

education classifications: less then 8 years of education, 8 to 12 years education, and more than 12 years education. The distribution of client education is given in Table 5.7.

Three personal characteristics: the level of education, current age, and major disabling condition, are often used as proxies to measure the ability or aptitude to work of rehabilitation clients.

Table 5.7
Distribution of Client Education

Education Level	Number of Clients	Percentage of Total Data Set
No Education	207,183	28.75%
1-5 Yrs Education	18,205	2.53%
6-11 Yrs Education	210,367	29.19%
12 Yrs Education	206,785	28.70%
Some College	58,797	8.16%
College Graduate	14,853	2.06%
Post-Graduate Work	4,422	.61%
	720,612	100.00%

Disability as Reported at Referral-
Major Disabling Condition

The variables pertaining to disabling conditions are organized in 7 broad condition categories as shown in Table 5.8. It is not possible to assess the actual severity of a client's major disabling condition by reference to the condition classifications. Two persons with identical conditions may fare quite differently in the labor market due in part to differences in the severity of their conditions. There is no information on

Client Marital Status

Table 5.6 gives the distribution of client marital status. The marital status variable is often used to capture affects such as motivation, effort and the stability of the client--factors that may ultimately have an impact on the rehabilitation outcome. Some regression equations include variables to measure the effects of being married with a spouse present versus otherwise on the probability of successful completion of the program.

Table 5.6
Distribution of Client Marital Status

Marital Status	Number of Clients	Percentage of Total Data Set
Married	166,524	23.11%
Widowed	20,808	2.89%
Divorced	86,555	12.01%
Separated	43,707	6.07%
Never Married	274,556	38.10%
	592,150	82.18%

Education

The highest grade completed by clients educated under a regular educational system is recorded in a continuous format. For clients who report mental retardation as a major or secondary disabling condition their highest grade completed is not recorded as zero, but as a separate easily identifiable code. In the stratified benefit cost analysis (Chapter 7), we use three broad

Table 5.8
Distribution of Disability as Reported at Referral

Disability Type	Number of Clients	Percentage of Total Data Set
Visual Impairments	46,366	6.43%
Hearing Impairments	8,951	1.24%
Orthopedic Deformity or Functional Impairment	175,269	24.32%
Absence or Amputation of Major or Minor Members	11,056	1.54%
Psychoneurotic and Personality Disorders	161,175	22.37%
Mental Retardation	43,072	5.98%
Other Conditions with Etiology Unknown	45,351	3.95%
	720,612	100.00%

Client Weekly Earnings

Client weekly earnings at referral and at closure are intended to provide actual data on the cash earnings of the client in the week of referral (or closure) regardless of earnings prior to the week of referral (or closure). The distribution of client weekly earnings is given in Table 5.9.

To calculate benefits, we seek to learn how much of a gain in client weekly earnings from referral to closure can be attributed to participation in the VR program. But such a problem is still not completely solved. Various solutions have been suggested in the literature, but all are less than perfect due to the lack of an ideal comparison or control group. Due to the nature of the R-300 data set a researcher can only draw conclusions based on the success of a client (status 26) relative

the R-300 data set about specific functional limitations or motor movements which may affect performance in the labor market. Such information would be useful in the estimation of predictions of successful completion from VR or of the benefits and costs attributible to VR participation. (See Chapter 13).

However, through a variable recorded at the time of closure from the VR program, (the federal special program identifier variable) a counselor will designate a client as severely disabled if the definition of severe disability as defined in the <u>RSA Manual</u> is met. This provides a general measure of severity of impairments.

In our stratified benefit cost analysis we make an alternative specification of the disability classifications to lower the required number of explanatory variables in a regression equation. In this analysis we broaden the classifications as follows:

Combine the Visual (RSA codes: 100-150) and Hearing (200-230) Impairments into one "sensory" limitation, the Orthopedic (300-399) and Amputation (400-449) Impairments into a "physical" impairment, split the Mental, Psychoneurotic and Personality Disorders category into 2 classifications: into an "mental illness" variable (500-522) and into a "mental retardation" variable (RSA codes: 530-534) and then place the remaining disability groups into the "other" classification.

Cost of Case Services

A major portion of the total costs estimated in the benefit cost analysis of the VR program, are case service costs. The R300 case service record provides the amount of case service costs to the vocational rehabilitation agency for each client. Table 5.10 gives a breakdown of the number of clients reporting a given amount of case service cost.

Table 5.10
Distribution of Costs of Case Services

Dollars of Services Purchased	Number of Clients	Percentage of Total Data Set
$ 00 to $ 50	295,771	41.0%
$ 51 to $ 200	40,779	5.7%
$101 to $ 150	33,252	4.6%
$151 to $ 200	19,236	2.7%
$201 to $ 300	21,225	2.9%
$301 to $ 500	30,476	4.2%
$501 to $1000	40,805	5.7%
$1000 to $5000	77,719	10.8%
Over $5000	161,349	22.4%
	720,612	100.0%

Service Provided by the VR Agency

Aside from evaluating the actual case service costs per VR client, it is often informative to know the usage frequency for each type of service or training. With the use of categorical variables it is possible to discern how much of an influence or lack of it, each service or training type has on the client's anticipated success from the program. Table 5.11 shows the number of clients receiving a given type of service or training.

to the remaining nonsuccessfully rehabilitated clients (statuses 08, 28, 30).

A selection-bias problem is introduced in the analysis because all clients, whether successfully rehabiltated or not, have made a prior decision to participate in the VR program. (See chapters 8 and 9). Here, the problem is that individuals who decide to participate in a rehabilitation program have characteristics that differentiate them from individuals who have decided against participation.

Table 5.9
Distribution of Client Weekly Earnings

Earnings Per Week	Number of Clients At Referral At Closure	Percentage of Total Data Set
$00 to $50	523,241 53,513	72.61% 7.43%
$51 to $100	18,1[illegible]3 25,010	2.52% 3.47%
$101 to $150	19,034 55,654	[illegible].64% .72%
$151 to $200	9,676 41,463	1.[illegible]4% 5.75 %
Over $200	10,280 38,938	1.43 % 5.40 %
Not Reported	140,248 506,034	19.46% 70.22%
	720,612	100.00%

truly random sample since each client's record is selected at random and not stratified by any client characteristic.

The resultant 1 percent sample has 7193 observations. The population has 720,612 observations.

Our basis for using 1 percent of the population data as opposed to 100 percent of the data lies in the argument of increased sampling precision versus additional sampling cost. As the standard error of the sample mean decreases the precision with which the sample mean can be used to estimate the population mean increases. Since the standard error of the sample mean is inversely related to the size of the sample, the larger the sample size the smaller the standard error. However, the increased precision may not be worth the additional sampling cost.

Representativeness of the Sample

If our sample is truly a random sample, there should be no significant difference in the mean value of a variable in the sample and the mean value of the variable in the population. We conducted various tests and examinations of the sample to check the representativeness of the sample. Table 5.12 shows the calculation of a 95 percent confidence interval for certain key continuous variables. For each of the 12 variables, the sample mean fall within the confidence interval, thus we conclude that there is no significant difference in the sample and population

Table 5.11
Distribution of Services Provided by the VR Agency

Service Provided	Provided W/Cost To Agency	Provided W/O Cost To Agency	Provided W/ & W/O To Agency
Diagnostic and Evaluation	208,720	38,554	87,239
Restoration (Physical or Mental)	78,077	24,213	16,358
Training:			
College	25,342	3,327	9,773
Elementary or High Sch.	4,947	6,413	1,560
Business Sch. or College	5,914	1,277	1,719
Vocational School	28,768	6,319	7,341
On-the-Job	7,268	6,612	1,440
Personal and Adjustment	46,700	21,043	7,435
Misc.	27,164	9,049	4,518
Maintenance	57,616	13,982	6,843
Other Services	69,063	8,762	15,195
Services to Other Family Members	4,495	2,977	395

Selecting a 1 percent Sample

From the national R300 data set we selected a 1 percent random sample with each data observation having an equal probability of being selected for inclusion in the sample.

The selection technique involved the initialization of a random number stream with a "seed". The seed was set equal to a computer clock observation which returned an observation for the sample based upon the clock reading. This technique draws a

Table 5.12
Population and Sample Means of Continuous Variables and Calculation of the .95 Acceptance Region

Variable	No. of Observ. (Pop.)	Mean (Pop.)	Standard Deviation (Pop.)	No. of Observ. (Sample)	Mean (Sample)	Std Error of Sample Mean	Upper Confidence Interval	Lower Confidence Interval
AGEREF	714,737	33.03	13.57	7,142	33.24	0.1606	33.35	32.72
EDUC	515,840	10.90	2.65	5,120	10.92	0.0370	10.97	10.83
FAMSIZ	590,101	2.84	1.86	5,887	2.81	0.0243	2.89	2.79
MO1024	348,640	21.86	20.32	3,493	21.53	0.3438	22.53	21.19
WEARNR	70,049	$140.6	131.49	685	$148.28	5.0240	$150.48	$130.79
WEARNRZ	580,364	[illegible]	64.70	5,775	$17.59	0.8514	$18.64	$15.31
WEARNC	181,103	$161.44	99.40	1,826	$164.77	2.3261	$166.00	56.88
WEARNCZ	214,578	$136.26	108.49	2,154	$139.68	2.3376	$140.84	$131.67
SERVD	358,537	$1,054.13	2,344.88	3,587	$1,128.90	39.1521	$1,130.86	$977.39
SERVDZ	574,101	$658.32	1,922.10	5,741	$705.34	25.3677	$708.04	$608.60
REHABD	80,685	$1,441.66	2,444.89	847	$1,497.25	84.0073	$1,606.31	$1,277.01
REHABDZ	635,173	$183.13	994.88	6,332	$200.28	12.5025	$207.64	$158.63

NOTE:
AGEREF = Age at Referral
EDUC = Highest Level of Education
FAMSIZ = Family Size
MO1024 = Months in Statuses 10-24
WEARNR = Weekly earnings at referral (excluding those reporting no earnings at referral)
WEARNRZ = Weekly earnings at referral
WEARNC = Weekly earnings at closure (excluding homemakers)
WEARNCZ = Weekly earnings at referral
SERVD = Total service purchased (excluding those reporting no service dollars purchased)
SERVDZ = Total service dollars purchased
REHABD = Total rehabilitation dollars purchased (excluding those reporting zero dollars purchases)
REHABDZ = Total rehabilitation dollars purchased

Hypothesis testing of means-
Large samples with population standard deviations known.

We derived the .95 acceptance interval as follows:

Upper limit = $\mu + 1.96\sigma_{\bar{x}}$
Lower limit = $\mu - 1.96\sigma_{\bar{x}}$

where μ is the population mean,
$\sigma_{\bar{x}}$ is the standard error of the mean
1.96 is the z value for the .05 significance level

If the sample mean falls within this confidence interval, we can accept the hypothesis that there is no difference between the population mean and the sample mean.

means. In Table 5.13, we test the significance of specific discrete variables including race and sex. Here, the test is to determine whether or not the sample proportion lies within a 95 percent confidence interval. If the sample proportion falls within this interval then we conclude that there is no difference between proportions. We reach this conclusion for all the variables we tested.

Limitations of the Sample

One limitation of this randomly selected sample is the lack of opportunity for statistical interrogation into subclassifications within the sample. Our random sample was intended to give a broad representation of the population data set as a whole. If an in-depth analysis of successful rehabilitants by age at referral, sex, race, education and marital status is desired (See chapter 7), then a stratified sample would more accurately reflect the characteristics of the population. Or, if an in-depth analysis of successful rehabilitants from predefined regions across the United States, by age at referral, sex, race, education and marital status is desired, then cluster sampling techniques would produce a more precise sample from the population.

The size of the random sample can also be a limitation. If one is conducting analysis on the national level, the 1 percent random sampl [illegible] be adequate. However, if one is conducting state by st te analysis or analysis across disability groups, the

Table 5.13
Population and Sample Proportions of Discrete Variables and Calculation of the .95 Acceptance Region

Variable	Proportion	Proportion	Proportion	Interval	Interval
Sex					
Male	0.59	0.584	0.005856	0.6015	0.5785
Female	0.41	0.416	0.005856	0.4215	0.3985
Race					
White	0.773	0.775	0.0051[illegible]4	0.7830	0.7630
Black	0.206	0.206	0.0049[illegible]7	0.2157	0.1963
Other	0.021	0.019	0.00174,	0.0244	0.0176
Marital Status					
Married	0.281	0.278	0.005845	0.2925	0.2695
Other	0.719	0.722	0.005845	0.7305	0.7075
Closure Status					
Status 08	0.513	0.51	0.005893	0.5246	0.5014
Status 26	0.3	0.302	0.005403	0.3106	0.2894
Status 28	0.137	0.137	0.004054	0.1449	0.1291
Status 30	0.051	0.051	0.002594	0.0561	0.0459
Major Disability					
Millness	0.164	0.168	0.005153	0.1741	0.1539
Mretard	0.271	0.274	0.006186	0.2831	0.2589
Physical	0.565	0.558	0.006900	0.3785	0.3515
Service Received					
Educ	0.177	0.186	0.007775	0.1922	0.1618
Restortive	0.499	0.489	0.010185	0.5190	0.4790
Training	0.324	0.325	0.009533	0.3427	0.3053

Hypothesis testing of proportions
Large samples with population proportions known.

We derived the .95 acceptance interval as follows:

upper limit = $p + 1.96\,\sigma_{\bar{p}}$
lower limit = $p - 1.96\,\sigma_{\bar{p}}$

where p is the population proportion
$\sigma_{\bar{p}}$ is the standard error of the proportion
1.96 is the z value for the .05 significance level

If the sample proportion falls within this acceptance region, we can accept the hypothesis that there is no difference between the population and sample proportions

1 percent sample may be too small to fully represent the population. If this is the case, a random sample of 5 percent could be created and would provide a better representation of the population.

Chapter 6

SIMPLE BENEFIT COST RATIOS

Ernest Gibbs*

In this section, we calculate and compare simple benefit cost ratios for the population and the random sample. We then check to see if there are any major differences in the benefit cost ratio calculated from the population data and the ratio derived from the random sample. In calculating the benefit cost ratios, we use a simple methodology that has been used by the RSA. In later work we calculate these benefit cost ratios using more complex methods. (See Chapter 7). Our use of this simple method is designed to test the representativeness of the sample and not to condone the method of calculating these ratios.

It should be noted that if the total costs and benefits estimated from the sample data are comparable to the results from the population, then the benefit and cost figures from the sample should be approximately 1 percent of the corresponding benefit and costs figures of the population.

Computation of Cost

The major costs of the VR program consist of program costs - case service costs, which are variable costs, and overhead costs,

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which can be considered a fixed cost. When estimating the total costs in the benefit cost ratio, we must take both types of costs into account. To estimate the total case service costs, we take the average costs of clients with positive case service costs and then aggregate to attain a total cost figure.

The total case service cost for the 215,569 clients successfully rehabilitated (closure status 26) in the population was $253.9 million. However, of the 215,569 clients, only 154,338 clients incurred a case service cost of at least one dollar. It was from these clients that the non-zero cost of case services was computed. The non-zero mean cost of case services for the 215,569 clients in the population who were successfully rehabilitated was approximately $1,645 (See Table 6.1).

In our random sample, the total case service cost for the 2,169 successfully rehabilitated clients was $2,807,688. However, only 1,582 clients of these 2,169 reported a positive case service cost. The non-zero mean case service cost was computed for only those 1,582 clients who incurred or reported a case service cost of a least one dollar. This non-zero mean cost of case services rehabilitated was $1,775. From our hypothesis test (see Chapter 5), we know that this sample non-zero mean is not significantly different from the non-zero mean of the population.

Next, we estimate the case service cost for those clients who either reported no case service cost or who incurred zero case

Table 6.1
Total and Mean Case Service Costs
By Closure Code for the
Population and Random Sample

(1) Closure Code	(2) Number Closed (Sample)	(3) Number Closed (Population)	(4) Number Reporting Positive Costs (Sample)	(5) Number Reporting Positive Costs (Population)	(6) Total Case Service Dollars (Sample)	(7) Total Case Service Dollars (Population)	(8) Non-Zero Mean of Service Dollars (Sample)	(9) Non-Zero Mean of Service Dollars (Population)
08	3,673	369,681	1,073	110,081	$245,399	$24,961,504	$228.70	$226.75
26	2,169	215,569	1,582	154,338	$2,807,688	$253,870,873	$1,774.77	$1,644.90
28	984	98,935	700	70,439	$939,797	$93,138,765	$1,342 57	$1,322.26
30	367	36,427	232	23,679	$56,479	$5,971,811	$243.44	$252.20
TOTAL	7,193	720,612	3,587	358,537	$4,049,363	$377,942,953		

Table 6.2
Estimation of Total Case Service Costs
By Closure Code for the
Population and Random Sample

(1) Closure Code	(2) Total Reported Service Costs (Sample)	(3) Total Reported Service Costs (Population)	(4) Total Service Costs Received By Those Not Reporting or Reporting Zero* (Sample)	(5) Total Service Costs Received By Those Not Reporting or Reporting Zero* (Population)	(6) Total Case Service Cost (Sample) (2)+(4)	(7) Total Case Service Cost (Population) (3)+(5)
08	$245,399	$24,961,504	$594,620	$58,866,896	$840,019	$83,828,400
26	$2,807,688	$253,870,873	$1,041,790	$100,718,872	$3,849,478	$354,589,745
28	$939,797	$93,138,765	$381,290	$37,679,121	$1,321,087	$130,817,886
30	$56,479	$5,971,811	$32,864	$3,215,046	$89,343	$9,186,857
TOTAL	$4,049,363	$377,942,953	$2,050,564	$200,479,934	$6,099,927	$578,422,887

* These costs are estimated using the RSA methodology. The totel cost for those who did not report or did not incur any costs is celculated by multiplying the number reporting either zero or not reporting any costs by the non-zero mean.

service cost. The method used to estimate these costs is to assign the non-zero mean rehabilitation cost to this group of clients. This method will tend to overestimate costs by assigning the non-zero mean to those who reported zero case service costs. This is because some of these clients received only "in-house" services, such as placement, counseling, administrative, or overhead costs and had no case service costs. Assuming the same mean rehabilitation cost of $1,645 for the remaining 61,231 successfully rehabilitated clients in the population, yields $100.7 million. Thus the grand total case service cost of all 215,569 successfully rehabilitated clients is $354.6 million (See Table 6.2, column 7).

Using this technique to estimate cost for the 587 clients in the random sample successfully rehabilitated but who incurred zero case service costs or who did not report any case service cost, one arrives at a total of $1,041,790. This makes the grand total case service expenditure of the 2,169 successfully rehabilitated in the random sample $3,843,478.

These total expenditures are incomplete since they omit cost for services received by clients whose cases were closed not rehabilitated and on others who were not accepted for VR services (i.e. closure statuses 08, 28,30). The method outlined above was used to estimate the total case service cost of these persons. The non-zero mean of case service costs of each closure status was assigned to clients in that status (See Table 6.2, columns 6

and 7).

Given this method of computing costs, the estimated case service costs on all cases closed in Fiscal Year 1982, was $578.4 million. The estimated cost figure overestimates the service costs as reported in RSA-2. In this report, the total case service expenditures to all individuals was $521.6 million.

For the random sample, the estimated case service cost on all closures was approximately $6 million.

Another major cost area in the provision of rehabilitation services is expenditures for guidance, counseling, placement assistance, and the administration of the program. Based on data contained in Form RSA-2, these costs were 55.3 percent of all rehabilitation expenditures in Fiscal Year 1982. The remaining 44.7 percent of total expenditures was the case service costs reported on cases closed in Fiscal Year 1982. Therefore, the grand total cost of services rendered to clients can be obtained by dividing the total case service cost of 578.4 million by .447. For the population, this yields a grand total of $1,294 million. Again this figure overestimates the $1,166 million reported in RSA-2 as the total obligation. For the random sample, the estimated grand total is $13.6 million. These total cost figures serve as the denominator of the benefit cost ratios.

Computation of Long-Term Improvement in Earnings

In this benefit cost model, we define the benefits of the VR program as simply the difference of wages at closure and at referral. The annual increase in weekly earnings of all clients rehabilitated in 1982 is $1,207.6 million (See Table 6.3). This is calculated by taking the difference in the mean weekly earnings of clients from referral to closure and aggregating over all rehabilitated persons, including those with zero earnings. This figure is then raised to aggregate annual earnings changes by multiplying by 50. Again, using this method, the annual increase in weekly earnings of the clients in the random sample is $12.4 million.

The aggregate earnings improvement is then discounted over a thirty year period. The thirty year period is chosen because the average age of rehabilitated clients is approximately 35, which would leave approximately 30 working years until the assumed retirement age of 65. The discounting function used was twelve percent. The present value of one dollar received annually for thirty years discounted at twelve percent per year is $8.055. Multiplying this factor by $1,207.6 million yields $9,727.2 million. This is the projected lifetime improvement in earnings accumulated over thirty years which VR maintains is attributed to vocational rehabilitation intervention. For the random sample, the projected aggregated lifetime improvement in earnings accumulated over the thirty year period is $100.1 million.

Table 6.3
Mean Weekly Earnings of Successfully Rehabilitated Clients at Referral and Closure, Projected at Annual Rates

Number of Clients	Mean Weekly Earnings: At Referral (1)	Mean Weekly Earnings: At Closure (2)	Annual Aggregate Earnings: (3) At Referral (in thousands)	Annual Aggregate Earnings: (3) At Closure	Differnce Between Referral and Closure Earnings (in thousands)
2,169	$25.08	$139.68	$2,720	$15,158	$12,429
215,569	$24.22	$136.26	$261,054	$1,468,672	$1,207,618

(1) includes those reporting no weekly earnings at referral

(2) includes homemakers

(3) weekly earnings were annualized by multiplying by 50 and then by the total number of rehabilatations

Table 6.4
Benefit/cost Ratios
Present Value of Improved Earnings
Projected for Five to Thirty years
and Discounted at 12% per Year

Period	Present Value of One Dollar Discounted at 12 %	Future Earnings Discounted at 12 % Per Year (Population)	Future Earnings Discounted at 12 % Per Year (Sample)	Benefit/ Cost Ratio (Population)	Benefit/ Cost Ratio (Sample)
5 years	$3.605	$4,353,461,224	$44,802,940	$3.36	$3.28
10 years	$5.650	$6,823,039,090	$70,218,200	$5.27	$5.15
15 years	$6.811	$8,225,083,051	$84,647,108	$6.36	$6.20
20 years	$7.469	$9,019,695,391	$92,824,732	$6.97	$6.80
25 years	$7.843	$9,471,344,351	$97,472,804	$7.32	$7.14
30 years	$8.055	$9,727,359,269	$100,107,540	$7.52	$7.34

Dividing the discounted life-time earnings aggregates by the total cost of the rehabilitation produces benefit cost ratio of $7.52 (i.e. $9,727.2/$1,294 = $7.52) for the entire population, (See Table 6.4). For the random sample, the benefit cost ratio is $7.34 ($100.1/$13.6 = $7.34).

Comparision of the Results

As shown, the computed benefit cost ratio for the population was $7.52 as compared with $7.34 for the random sample. Since we can not statistically test to see if the difference is significant, it is left to individual judgement to decide whether or not these ratios are approximately the same. For all the benefit cost ratios calculated (see Table 6.4), the largest difference between the ratio for the population and the ratio for the sample is 18 cents. Given that there are many estimations needed to derive the figures necessary to compute these ratios, this difference does not seem meaningful.

Besides comparing the benefit cost ratios of the population versus the sample, one might also want to compare the total costs and benefits calculated for each group. If one multiplied the total costs and benefits estimates of the sample by 100, they should be approximately equal to those of the population. Again, it is not possible to statistically test the differences, but it i ar judgement that the figures are roughly the same.

Chapter 7

BENEFIT COST RATIOS USING MULTIVARIATE ANALYSIS

Ernest Gibbs

In Chapter 6, we examined a simple benefit cost model. In this chapter, we apply some of the corrections cited in Chapter 3 and complicate the simple benefit cost analysis by employing multivariate methods of measurement. We use regression analysis to estimate benefit cost relationships for subgroups or cohorts of clients in the Vocational Rehabilitation program.

We stratify the clients on the R-300 data set by age, race, sex, education, and disabling condition. There are many possible ways to stratify individuals and thousands of possible combinations of characteristics. In our study, we choose five age classes, three education groups, five disability classifications, along with two groups for both race and sex. Table 7.1 shows the method and categories used to stratify the data set. We now can analyze the impact of say, additional education, while controlling for disabling condition, age, race and sex.

Given this method of stratification, we have a total of 300 cohorts or cells. Table 7.2 gives the frequency of individuals in each cohort.

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Table 7.1

VARIABLE DEFINITIONS
PROBABILITY OF SUCCESS

NAME	CODE	VALUE
AGE	AGE 00	= 1 if 14 - 24, 0 otherwise
	AGE 25	= 1 if 25 - 34, 0 otherwise
	AGE 35	= 1 if 35 - 44, 0 otherwise
	AGE 45	= 1 if 45 - 54, 0 otherwise
	AGE 55	= 1 if 55 - 64, 0 otherwise
SEX	SEXM	= 1 if Male, 0 otherwise
	SEXF	= 1 if Female, 0 otherwise
RACE	RACEW	= 1 if White, 0 otherwise
	RACEB	= 1 if Black, 0 otherwise
EDUCATION	ED8	= 1 if 0 - 8th grade, 0 otherwise
	ED9	= 1 if 9th - 12th grade, 0 otherwise
	ED13	= 1 if 13+, 0 otherwise
DISABLING CONDITION	SENSORY	= 1 if sensory, 0 otherwise /1
	ORTHO/AMPUT	= 1 if orthopedic or amputation, 0 otherwise /2
	MILL	= 1 if mentally ill, 0 otherwise /3
	MRET	= 1 if mentally retarded, 0 otherwise /4
	OTHER	= 1 if other, 0 otherwise /5

/1 SENSORY includes disability codes 100 to 229.
/2 ORTHO/AMPUT includes disability codes 300 to 449.
/3 MILL includes disability codes 500 to 529.
/4 MRET includes disability codes 530 to 534.
/5 OTHER includes disability codes greater than 600.

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Table 7.2

FREQUENCY OF SUCCESSFUL REHABILITANTS BY COHORT

WHITE MALE

0 - 8 YEARS EDUCATION

COHORT/AGE	15-24	25-34	35-44	45-54	55+	TOTAL
SENSORY	205	179	229	430	1,590	2,[illegible]33
ORTHO/AMPUT	609	801	1,[illegible]	940	573	3,929
MENTAL ILL	1,403	787	626	445	231	3,490
OTHER	734	[illegible]34	594	764	558	3,184

9 - 12 YEARS EDUCATION

COHORT/AGE	15-24	25-34	35-44	45-54	55+	TOTAL
SENSORY	1,472	752	675	681	1,718	5,298
ORTHO/AMPUT	7,192	5,849	3,448	1,776	847	19,110
MENTAL ILL	6,268	4,889	4,209	1,098	359	14,823
OTHER	4,945	2,059	1,323	1,146	706	10,179

13+ YEARS EDUCATION

COHORT/AGE	15-24	25-34	35-44	45-54	55+	TOTAL
SENSORY	272	393	176	158	425	1,426
ORTHO/AMPUT	1,172	2,293	993	469	237	5,164
MENTAL ILL	696	2,252	1,170	577	184	4,879
OTHER	647	833	368	359	207	[illegible],414

BLACK MALES

0 - 8 YEARS EDUCATION

COHORT/AGE	15-24	25-34	35-44	45-54	55+	TOTAL
SENSORY	72	49	56	97	210	484
ORTHO/AMPUT	118	152	268	263	220	1,021
MENTAL ILL	399	272	182	122	44	1,019
OTHER	156	111	130	214	169	800

9 - 12 YEARS EDUCATION

COHORT/AGE	15-24	25-34	35-44	45-54	55+	TOTAL
SENSORY	310	220	147	93	93	863
ORTHO/AMPUT	780	893	541	297	109	2,620
MENTAL ILL	1,442	1,589	640	194	53	3,918
OTHER	743	532	319	188	73	1,855

13+ YEARS EDUCATION

COHORT/AGE	15-24	25-34	35-44	45-54	55+	TOTAL
SENSORY	34	57	32	15	16	154
ORTHO/AMPUT	107	261	105	48	23	544
MENTAL ILL	120	390	152	44	9	715
OTHER	98	118	63	33	15	327

Table 7.2
(con't)

FREQUENCY OF SUCCESSFUL
REHABILITANTS BY COHORT

WHITE FEMALES

0 - 8 YEARS EDUCATION

COHORT/AGE	15-24	25-34	35-44	45-54	55+	TOTAL
SENSORY	205	279	229	430	1,590	2,633
ORTHO/AMPUT	272	330	411	620	564	2,197
MENTAL ILL	607	519	441	409	131	2,107
OTHER	501	543	737	918	770	3 469

9 - 12 YEARS EDUCATION

COHORT/AGE	15-24	25-34	35-44	45-54	55+	TOTAL
SENSORY	1,472	752	675	681	1,718	5,298
ORTHO/AMPUT	3,828	2,757	2,436	1,889	1,054	11,964
MENTAL ILL	4,554	4,635	2,798	1,443	402	13,832
OTHER	4,360	2,961	2,025	1,461	829	11,636

13+ YEARS EDUCATION

COHORT/AGE	15-24	25-34	35-44	45-54	55+	TOTAL
SENSORY	272	393	176	158	425	1,426
ORTHO/AMPUT	835	1,156	676	442	224	3.333
MENTAL ILL	798	1,957	949	485	143	4,332
OTHER	604	710	360	210	92	1,976

BLACK FEMALES

0 - 8 YEARS EDUCATION

COHORT/AGE	15-24	25-34	35-44	45-54	55+	TOTAL
SENSORY	44	48	59	158	440	749
ORTHO/AMPUT	59	77	111	195	232	674
MENTAL ILL	168	153	127	90	26	564
OTHER	104	111	235	389	302	[illegible]

9 - 12 YEARS EDUCATION

COHORT/AGE	15-24	25-34	35-44	45-54	55+	TOTAL
SENSORY	246	216	142	221	290	1,115
ORTHO/AMPUT	[illegible]	534	544	427	223	2,111
MENTAL ILL	[illegible]	1,109	531	223	46	2,816
OTHER	697	892	301	610	226	3,226

13+ YEARS EDUCATION

COHORT/AGE	15-24	25-34	35-44	45-54	55+	TOTAL
SENSORY	37	58	23	39	44	201
ORTHO/AMPUT	84	164	114	72	31	467
MENTAL ILL	145	294	117	58	7	421
OTHER	140	172	103	55	20	490

MENTAL RETARD

	15-24	25-34	35-44	45-54	55+	TOTAL
WHITE MALE	7,205	1,750	737	399	194	10,285
BLACK MALE	3,841	420	117	56	24	4,458
WHITE FEMALE	4,489	1,366	606	329	146	7,336
BLACK FEMALE	2,321	405	149	59	15	2,949
TOTAL	70,160	51,220	31,850	22,691	16,875	192,796

Methodology for Stratified Benefit Cost Ratios

The basic methodology for the stratified benefit cost analysis using regression methods was set forth by B llante (1971, 1972). The basic model is described below.

The benefit cost ratios in this chapter are computed with the following formula:

$$[P_s(B_s) + (1-P_s)B_n]/[P_s(C_s) + (1-P_s)C_n]$$

where P_s = the probability that an individual with given characteristics will be successfully rehabilitated;

$(1-P_s)$ = the probability that the individual will not be rehabilitated;

B_s = the estimated lifetime benefits generated from the successful rehabilitation of a client with given characteristics;

B_n = the benefits attributed to the rehabilitation process for a client who is unsuccessfully rehabilitated after acceptance into the program. (In this present analysis, we assume B_n to be zero; in chapter 8 we impute earnings to persons closed out in statuses 28 and 30);

C_s = the estimated cost of rehabilitation of a client with given characteristics who is successfully rehabilitated;

C_n = the total estimated cost associated with a

client with a given set of characteristics who is closed unsuccessfully after acceptance into the program (i.e. closure status 28 or 30).

P_s, the Probability of Success

P_s, the probability of success, is determined by regressing the dichotomous dependent variable of success or lack of success on the given characteristics of each individuals.

Success is defined as being closed is status 26. To estimate the probability of success, the categorical independent variables, listed in Table 7.1, as well as the dependent variable, are converted to dummy variables. The regression for probability of success was run over the entire population of 350,931 clients. The ordinary least squares results of the regression are presented in Table 7.3. From these results, we see that the probability of success is positively related to age. The results also show that women are more likely to be successfully rehabilitated than men. This result may be due in part to the fact that women are more likely to be closed successfully as unpaid homemakers then men. Controlling for the other variables, whites have a higher probability of success than blacks. We also see that the education is positively related to the probability of success, the more education one has the more likely one is closed successfully.

Table 7.3

RESULTS OF REGRESSIONS

VARIABLE CODE	SUCCESS	COST (SUCCESS)	COST (NONSUCCESS)
AGE 00 (basis)	0	0	0
[illegible] 5	[illegible]04	-949.[illegible]	-429.27
AGE 35	0.0081	-1237.39	-672.40
AGE 45	0.0172	-1489 11	-911.45
AGE 55	0.1047	-2446.82	-1167.61
SEXF (basis)	0	0	0
SEXM	-0.0625	-444.65	-84.45
RACEB (basis)	0	0	0
RACEW	0.0719	585.44	193.69
ED8 (basis)	0	0	0
ED9	0.0349	-444.65	-209.24
ED13	0.0821	-165.32	4.03
MRET (basis)	0	0	0
SENSORY	0.0121	1266.56	1285.79
ORTHO/AMPUT	-0.0954	914.11	596.86
MILL	-0.1639	-516.10	-471.13
OTHER	-0.0357	586.64	29.51
INTERCEPT	0.6294	4044.36	2498.97

The probability of success across disability groups, from highest to lowest, are the sensory disability group, the mentally retarded, those classified in the other disability group, the orthopedic/amputation group, and those classified as mentally ill, who have the lowest probability of success.

The average probability of success of the basis group, those individuals having a zero value for all of the dummy variables, is given by the intercept term. The estimated probability that an individual, with a given set of characteristics will be successfully rehabilitated, P_s, can be calculated by summing the coefficients for the selected characteristics and adding this result to the intercept value The probability of success for each cohort is reported in Table 7.4.

Costs for Success and Nonsuccess

The costs for success, C_s, and the costs for nonsuccess, C_n, are estimated by regressing case service costs on the same set of independent variables. The regression of C_s was run over the 192,796 successful rehabilitants, while the regression of C_n was run over only the 158,135 non-rehabilitants. The results of these regressions will yield the estimated predicted case service costs. In addition to these costs, we must assign fixed, overhead costs. We multiply the estimated case service costs by the same factor as used in Chapter 5, in order to estimate the total cost figure.

Table 7.4

PROBABILITY OF SUCCESS

WHITE MALES

0 - 8 YEARS EDUCATION

DISABILITY/AGE	15-24	25-34	35-44	45-54	55+
SENSORY	0.65	0.65	0.66	0.67	0.76
ORTHO/AMPUT	0.54	0.54	0.55	0.56	0.65
MENTAL ILL	0.47	0.48	0.48	0.49	0.58
MENTAL RET	0.64	0.64	0.65	0.66	0.74
OTHER	0.60	0.60	0.61	0.62	0.71

9 - 12 YEARS EDUCATION

DISABILITY/AGE	15-24	25-34	35-44	45-54	55+
SENSORY	0.69	0.69	0.69	0.70	0.79
ORTHO/AMPUT	0.58	0.58	0.59	0.60	0.68
MENTAL ILL	0.51	0.51	0.52	0.53	0.61
MENTAL RET	0.67	0.67	0.68	0.69	0.78
OTHER	0.64	0.64	0.65	0.66	0.74

13+ YEARS EDUCATION

DISABILITY/AGE	15-24	25-34	35-44	45-54	55+
SENSORY	0.73	0.73	0.74	0.75	0.84
ORTHO/AMPUT	0.63	0.63	0.63	0.64	0.73
MENTAL ILL	0.56	0.56	0.57	0.57	0.66
MENTAL RET	0.72	0.72	0.73	0.74	0.83
OTHER	0.69	0.69	0.69	0.70	0.79

BLACK MALES

0 - 8 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	0.58	0.58	0.59	0.60	0.68
ORTHO/AMPUT	0.47	0.47	0.48	0.49	0.58
MENTAL ILL	0.40	0.40	0.41	0.42	0.51
MENTAL RET	0.57	0.57	0.57	0.58	0.67
OTHER	0.53	0.53	0.54	0.55	0.64

9 - 12 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	0.61	0.61	0.62	0.63	0.72
ORTHO/AMPUT	0.51	0.51	0.51	0.52	0.61
MENTAL ILL	0.44	0.44	0.45	0.46	0.54
MENTAL RET	0.60	0.60	0.61	0.62	0.71
OTHER	0.57	0.57	0.57	0.58	0.67

13+ YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	0.66	0.66	0.67	0.68	0.77
ORTHO/AMPUT	0.55	0.55	0.56	0.57	0.66
MENTAL ILL	0.49	0.49	0.49	0.50	0.59
MENTAL RET	0.65	0.65	0.66	0.67	0.75
OTHER	0.61	0.61	0.62	0.63	0.72

Table 7.4
(con't)

PROBABILITY OF SUCCESS

WHITE FEMALES
0 - 8 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	0.71	0.71	0.72	0.73	0.82
ORTHO/AMPUT	0.61	0.61	0.61	0.62	0.71
MENTAL ILL	0.54	0.54	0.55	0.55	0.64
MENTAL RET	0.70	0.70	0.71	0.72	0.81
OTHER	0.67	0.67	0.67	0.68	0.77

9 - 12 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	0.75	0.75	0.76	0.77	0.85
ORTHO/AMPUT	0.64	0.64	0.65	0.66	0.75
MENTAL ILL	0.57	[illegible]	0.58	0.59	0.68
MENTAL RET	0.74	0.74	0.74	0.75	0.84
OTHER	0.70	0.70	0.71	0.72	0.81

13+ YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	0.80	0.80	0.80	0.81	0.90
ORTHO/AMPUT	0.69	0.69	0.70	0.71	0.79
MENTAL ILL	0.62	0.62	0.63	0.64	0.72
MENTAL RET	0.78	0.78	0.79	0.80	0.89
OTHER	0.75	0.75	0.76	0.76	0.85

BLACK FEMALES
0 - 8 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	0.64	0.64	0.65	0.66	0.75
ORTHO/AMPUT	0.53	0.53	0.54	0.55	0.64
MENTAL ILL	0.47	0.47	0.47	0.48	0.57
MENTAL RET	0.63	0.63	0.64	0.65	0.73
OTHER	0.59	0.59	0.60	0.61	0.70

9 - 12 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	0.68	0.68	0.68	0.69	0.78
ORTHO/AMPUT	0.57	0.57	0.58	0.59	0.67
MENTAL ILL	0.50	0.50	0.51	0.52	0.61
MENTAL RET	0.66	0.66	0.67	0.65	0.77
OTHER	0.63	0.63	0.64	0.65	0.73

13+ YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	0.72	0.72	0.73	0.74	0.83
ORTHO/AMPUT	0.62	0.62	0.62	0.63	0.72
MENTAL ILL	0.55	0.55	0.56	0.56	0.65
MENTAL RET	0.71	0.71	0.72	0.73	0.82
OTHER	0.68	0.68	0.68	0.69	0.78

The results of the regressions on costs for successful and unsuccessful cases are given in Table 7.3. One car estimate the total cost for any client with a given set of characteristics by summing the dollar amounts of the coefficients of the desired characteristics and adding these to the intercept term. Estimated costs for successful and unsuccessful cases are reported in Tables 7.5 and 7.6, respectively. These values will yield the values of C_s and C_n, which are used in the benefit cost ratio. To compute the expected costs of a client with a particular set a characteristic, we add the product of the probability that that client will be rehabilitated and the estimated total cost of success to the product of the probability that the client will not be rehabilitated and the estimated cost of nonsuccess. That is, $P_s(C_s) + (1-P_s)C_n$ is the expected cost of a client. This expected cost figure is the denominator of the benefit cost ratio.

Benefits

In this analysis, we measure the benefits of Vocational Rehabilitation to clients as simply the difference of earnings at closure and earnings at referral. This wage gain is then compounded over the client's work life. However, the data concerning many clients earnings,at referral and closure, is incomplete. To correct for this we must make assumptions about the future earnings of these individuals.

Table 7.5

COSTS OF SUCCESS

WHITE MALES

0 - 8 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	5 452	4,502	4,214	3,963	3,005
ORTHO/AMPUT	5,099	4,149	3,862	3,610	2,652
MENTAL ILL	3,669	2,719	2,432	2,180	1,222
MENTAL RET	4,185	3,235	2,948	2,696	1,738
OTHER	4,772	3,822	3,534	3,283	2,325

9 - 12 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	5,007	4,057	3,770	3,518	2,560
ORTHO/AMPUT	4,655	3,705	3,417	3,166	2,208
MENTAL ILL	3,224	2,275	1,987	1,735	778
MENTAL RET	3,741	2,791	2,503	2,251	1,294
OTHER	4,327	3,377	3,090	2,838	1,880

13+ YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	5,286	4,337	4,049	3,797	2,840
ORTHO/AMPUT	4,934	3,984	3 697	3,445	2,487
MENTAL ILL	3,504	2,554	2,266	2,015	1,057
MENTAL RET	4,020	3,070	2,782	2,531	1,573
OTHER	4,606	3,657	3,369	3,117	2,160

BLACK MALES

0 - 8 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	4,866	3,916	3,629	3,377	2,419
ORTHO/AMPUT	4,514	3,564	3,276	3,025	2 067
MENTAL ILL	3,084	2,134	1,846	1,595	637
MENTAL RET	3,600	2,650	2,362	2,111	1,153
OTHER	4,186	3,237	2,949	2,697	1,740

9 - 12 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	4,422	3,472	3,184	2,933	1,975
ORTHO/AMPUT	4,069	3,119	2,832	2,580	1,622
MENTAL ILL	2,639	1,689	1,402	1,150	192
MENTAL RET	3,155	2,205	1,918	1,666	708
OTHER	3,742	2,792	2,504	2,253	1,295

13+ YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	4,701	3,731	3,464	3,212	2,254
ORTHO/AMPUT	4,349	3,399	3,111	2,859	1,902
MENTAL ILL	2,918	1,968	1,681	1,429	471
MENTAL RET	3,434	2,485	2,197	1,945	988
OTHER	4,021	3,071	2,784	2,532	1,574

Table 7.3
(con't)

COSTS OF SUCCESS

WHITE FEMALES
0 - 8 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	5,896	4,947	4,659	4,407	3,450
ORTHO/AMPUT	5,544	4,596	4,307	4,055	3,097
MENTAL ILL	4,114	3,164	2,876	2,625	1,667
MENTAL RET	4,630	3,680	3,392	3,141	2,183
OTHER	5,216	4,267	3,979	3,727	2,770

9 - 12 YEARS EDUCATION

SENSORY	5,452	4,502	4,214	3,963	3,005
ORTHO/AMPUT	5,099	4,149	3,862	3,610	2,652
MENTAL ILL	3,669	2,719	2,432	2,180	1,222
MENTAL RET	4,185	3,235	2,948	2,696	1,738
OTHER	4,772	3,822	3,534	3,283	2,325

13+ YEARS EDUCATION

SENSORY	5,731	4,781	4,494	4,242	3,284
ORTHO/AMPUT	5,379	4,429	4,141	3,889	2,932
MENTAL ILL	3,948	2,999	2,711	2,459	1,502
MENTAL RET	4,464	3,515	3,227	2,975	2,018
OTHER	5,051	4,101	3,814	3,562	2,604

BLACK FEMALES
0 - 8 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	5,311	4,361	4,074	3,822	2,864
ORTHO/AMPUT	4,958	4,009	3,721	3,469	2,512
MENTAL ILL	3,328	2,578	2,291	2,039	1,081
MENTAL RET	4,044	3,095	2,807	2,555	1,598
OTHER	4,631	3,681	3,394	3,142	2,184

9 - 12 YEARS EDUCATION

SENSORY	4,866	3,916	3,629	3,377	2,419
ORTHO/AMPUT	4,514	3,564	3,276	3,025	2,067
MENTAL ILL	3,084	2,134	1,846	1,595	637
MENTAL RET	3,600	2,650	2,362	2,111	1,153
OTHER	4,186	3,237	2,949	2,697	1,740

13+ YEARS EDUCATION

SENSORY	5,146	4,196	3,908	3,656	2,699
ORTHO/AMPUT	4,793	3,843	3,556	3,304	2,346
MENTAL ILL	3,363	2,413	2,126	1,874	916
MENTAL RET	3,879	2,929	2,642	2,390	1,432
OTHER	4,466	3,516	3,228	2,977	2,019

Table 7.6

COSTS OF NONSUCCESS

WHITE MALES

0 - 8 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	3,894	3,465	3,222	2,983	2,726
ORTHO	3,205	2,776	2,533	2,294	2,037
MENTAL ILL	2,137	1,708	1,465	1,226	969
MENTAL RET	2,[illegible]08	2,179	1,936	1,697	1,441
OTHER	2,638	2,208	1,965	1,726	1,470

9 - 12 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	3,685	3,255	3,012	2,773	2,517
ORTHO	2,996	2,567	2,323	2,084	1,828
MENTAL ILL	1,928	1,499	1,255	1,016	760
MENTAL RET	2,399	1,970	1,727	1,488	1,231
OTHER	2,428	1,999	1,756	1,517	1,261

13+ YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	3,898	3,469	3,226	2,987	2,730
ORTHO	3,209	2,780	2,537	2,298	2,042
MENTAL ILL	2,141	1,712	1,469	1,230	974
MENTAL RET	2,612	2,183	1,940	1,701	1,445
OTHER	2,642	2,212	1,969	1,730	1,474

BLACK MALES

0 - 8 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	3,700	3,271	3,028	2,789	2,533
ORTHO	3,011	2,582	2,339	2,100	1,844
MENTAL ILL	1,943	1,514	1,271	1,032	776
MENTAL RET	2,415	1,985	1,742	1,503	1,247
OTHER	2,444	2,015	1,772	1,533	1,276

9 - 12 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	3,704	3,062	2,819	2,793	2,323
ORTHO	3,015	2,373	2,130	2,104	1,635
MENTAL ILL	1,947	1,305	1,062	1,036	567
MENTAL RET	2,419	1,776	1,533	1,507	1,038
OTHER	2,448	1,806	1,562	1,537	1,067

13+ YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	3,491	3,275	3,032	2,580	2,537
ORTHO	2,802	2,586	2,343	1,891	1,848
MENTAL ILL	1,734	1,[illegible]18	1,275	823	780
MENTAL RET	2,205	1,989	1,746	1,294	1,251
OTHER	2,235	2,019	1,776	1,323	1,280

Table 7.6
(con't)

COSTS OF NONSUCCESS

WHITE FEMALES
0 - 8 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	3,978	3,549	3,306	3,067	2,811
ORTHO	3,290	2,860	2,617	2,378	2,122
MENTAL ILL	2,222	1,792	1,549	1,310	1,054
MENTAL RET	2,693	2,263	2,020	1,781	1,525
OTHER	2,722	2,293	2,050	1,811	1,555

9 - 12 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	3,769	3,340	3,097	2,858	2,602
ORTHO	3,080	2,651	2,408	2,169	1,913
MENTAL ILL	2,012	1,563	1,340	1,101	845
MENTAL RET	2,483	2,054	1,811	1,572	1,316
OTHER	2,513	2,084	1,841	1,601	1,345

13+ YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	3,982	3,553	3,310	3,071	2,815
ORTHO	3,294	2,864	2,621	2,382	2,126
MENTAL ILL	2,226	1,796	1,553	1,314	1,058
MENTAL RET	2,697	2,247	2,024	1,781	1,529
OTHER	2,726	[illegible]	2,054	1,81[illegible]	1,559

BLACK FEMALES
0 - 8 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	3,785	3,355	3,112	2,873	2,617
ORTHO	3,096	2,667	2,423	2,184	1,928
MENTAL ILL	2,028	1,599	1,355	1,116	860
MENTAL RET	2,499	2,070	1,827	1,588	1,331
OTHER	2,528	2,099	1,856	1,617	1,361

9 - 12 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	3,576	3,146	2,903	2,664	2,408
ORTHO	2,887	2,457	2,214	1,975	1,719
MENTAL ILL	1,819	1,399	1,146	907	651
MENTAL RET	2,290	1,8[illegible]0	1,617	1,378	1,122
OTHER	2,319	1,[illegible]0	1,647	1,408	1,152

13+ YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	3,789	3,360	3,116	2,877	2,621
ORTHO	3,100	2,671	2,427	2,188	1,932
MENTAL ILL	2,032	1,603	1,359	1,120	864
MENTAL RET	2,503	2,074	1,831	1,592	1,335
OTHER	2,533	2,103	1,860	1,621	1,365

Wage at Referral

From the R-300, we have information on the wage of the client at referral, which is defined as the wage the individual earned during the week prior to their entry into the program. Thus, if they were unemployed during this period, their wage at referral would be zero. One assumption that could be made is that those individuals who had zero earnings at referral would have [illegible] ze[illegible] earnings if they had not entered the VR program. In our first measure of the benefits of VR, we follow this assumption.

This assumption, however, could lead to a gross overestimation of benefits. It is unrealistic to assume that a person who reports no earnings at referral would continue without earnings for the rest of their life. One alternative is to assume that those persons who reported zero wage at referral would have eventually earned the same mean wage as persons in their cohort with positive wages, even without the intervention of the VR program. In the remaining two measures of benefits, we follow this assumption. A third way to deal with the problem of zero reported earnings at referral, would be to use a two - stage selection bias method to impute earnings for these particular clients. This work is done in the next chapter.

Wages at Closure

Wages for successful rehabilitants that are reported on the R-300 data set, are based on the wage they earned after 60 days

on their job. However, some rehabilitants, especially homemakers, are placed in unpaid positions. To attain a measure of their value in the market place we assigned these individuals the mean wage of their cohort.

The wages at referral and at closure are not assumed to remain constant over the work life of the rehabilitant. They must be adjusted for several factors, which include unemployment, productivity and mortality. The future wages must also be discounted by an appropriate social discount rate.

To account for periods of unemployment, wages at closure are adjusted downward by 20 percent in each of the measures of benefits. In the last two measures of benefits, where we assigned the mean wage at referral to those clients who reported zero earnings, we adjusted wages at referral downward by 30 percent.

To account for the productivity growth of labor over time, we adjusted by a productivity growth factor. In our ratios we used growth rates of 2.5 and 3 percent.

Another factor that must be accounted for is mortality, because not all rehabilitants will live until the normal retirement age, which we have assumed to be 65. Therefore, the projections of wages at referral and closure were adjusted using mortality rates found in the <u>Life Tables for the United States</u>.

Future wage gain must be discounted by an appropriate social discount rate. The choice of a discount rate is important, since

it can crucially affect the resulting benefit cost ratios. In our analysis we use discount rates of 10 and 12 percent.

Wage Projections

After accounting for these adjustments, wages must be projected over the work life of the clients to compute a measure of lifetime earnings. In the first two models we used the following formula to project wages and calculate benefits:

$$B = \sum_{N=A}^{64} [(WC_N)(M_N)(U_N)(1+P)^{N-A+0.5}]/(1+R)^{N-A+1}$$

$$-\sum_{N=A}^{64} [(WR_N)(M_N)(U_N)(1+P)^{N-A+0.5}]/(1+R)^{N-A+1}$$

where: B = the discounted benefit stream;

WC_N = the client's wage at closure;

WR_N = the client's wage at referral;

M_N = the mortality adjustment;

U_N = the unemployment adjustment;

P = the productivity adjustment;

R = the social discount rate;

A = the client's age.

In the first measure of benefit, we assigned the mean wage at closure to those clients with zero wage at closure, but did not assign the mean wage to those who reported no wage at referral. In the second measure, we assigned the mean wage to all clients who reported zero wage, either at referral or closure.

For both of these measures of benefits, we conducted sensitivity analyses to examine the effects of different productivity growth rates and social discount rates. The benefit variables and combinations of productivity increases and discount rates associated with them are as follows:

Benefit Variable	Productivity Rate	Discount Rate
*		
Ben1.11	0.025	0.10
Ben1.12	0.025	0.12
Ben1.21	0.03	0.10
Ben1.22	0.03	0.12
**		
Ben2.11	0.025	0.10
Ben2.12	0.025	0.12
Ben2.21	0.03	0.10
Ben2.22	0.03	0.12

* Ben1 denotes those benefit variable estimated using the first assumption.

** Ben2 denotes those benefit variable estimated using the second assumption.

Age-Earning Profiles

This type of projection method is one of simple compounding. Another method to project earnings would be to assume that the wages of an individual would follow an age-earnings profile. The methodology of using age-earnings profile to project wages in benefit cost analysis is set forth by Conley (1973) and Worrall (1978). We use the mean earnings of the stratified cohorts to calculate the estimated future mean earnings of a worker, age 18, as he move into successive age groups. Thus we are able to

convert our cross sectional data into a time series. The formula used to dynamize the cross section is:

$$V = W\,(1+P)^{n-18}\,[1 + (1+P) + (1+P)^2 + \ldots + (1+P)^{i-1}]\,/\,i$$

where W = the mean earnings in the age interval in 1982;

n = the lowest age in interval;

i = number of years in age interval;

P = the productivity adjustment;

To construct the age-earnings profile for wages at closure, we used the mean wage of the stratified cohorts. We adjusted all earnings downward by an assumed 20 percent unemployment rate. The age-earnings profiles for each cohort is reported in Table 7.7. Figure 7.1 illustrates the shape of some of our estimated age-earning profiles.

In a third measure of benefit, we use these age-earnings profile to project wages at closure. We assume that the earnings of the individual over the course of his life will follow the shape of his cohorts age-earnings profile. We also assume a constant difference between his wage and the mean wage of his cohort. In this method of computing benefits, we also construct age-earnings profiles to project wages at referral. Here we assigned those clients who reported zero wage at referral the non-zero mean wage of their cohort at referral and assumed a 30% unemployment rate for wages at referral. This measure of benefit was derived using a 2.5 percent productivity growth rate and a 10

Table 7.7

EXPECTED FUTURE EARNINGS
FOR AN 15 YEAR OLD
(IN DOLLARS)

WHITE MALES

0 - 8 YEARS EDUCATION

DISABILITY/AGE	15-24	25-34	35-44	45-54	55+
SENSORY	3,827	5,776	7,629	8,820	5,647
ORTHO/AMPUT	4,897	7,923	10,655	11,730	9,225
MENTAL ILL	5,815	7,934	10,821	12,419	13,475
OTHER	5,053	6,910	10,100	12,234	11,728

9 - 12 YEARS EDUCATION

DISABILITY/AGE	15-24	25-34	35-44	45-54	55+
SENSORY	7,802	9,449	11,665	11,718	7,799
ORTHO/AMPUT	8,014	11,015	13,878	15,323	11,612
MENTAL ILL	6,741	9,698	12,421	15,038	15,916
OTHER	7,518	9,668	12,989	16,112	16,864

13+ YEARS EDUCATION

DISABILITY/AGE	15-24	25-34	35-44	45-54	55+
SENSORY	9,094	12,073	14,705	17,396	10,487
ORTHO/AMPUT	10,026	12,314	16,022	18,269	17,792
MENTAL ILL	7,580	10,410	14,106	18,372	19,947
OTHER	9,822	11,091	15,975	21,042	25,546

BLACK MALES

0 - 8 YEARS EDUCATION

DISABILITY/AGE	15-24	25-34	35-44	45-54	55+
SENSORY	4,205	5,774	4,684	5,874	4,859
ORTHO/AMPUT	5,057	5,342	8,102	9,081	6,138
MENTAL ILL	5,550	7,358	9,295	11,969	10,983
OTHER	5,448	6,817	8,525	9,543	9,981

9 - 12 YEARS EDUCATION

DISABILITY/AGE	15-24	25-34	35-44	45-54	55+
SENSORY	6,399	7,432	7,789	6,300	4,335
ORTHO/AMPUT	6,469	8,398	10,453	10,987	9,101
MENTAL ILL	5,873	8,230	11,239	13,178	13,900
OTHER	6,281	8,005	10,157	12,154	14,015

13+ YEARS EDUCATION

DISABILITY/AGE	15-24	25-34	35-44	45-54	55+
SENSORY	7,242	8,614	12,734	13,186	5,503
ORTHO/AMPUT	7,800	10,812	13,674	16,090	11,208
MENTAL ILL	6,632	9,415	12,879	17,430	21,019
OTHER	7,288	9,304	12,488	17,291	17,311

Table 7.7
(con't)

EXPECTED FUTURE EARNINGS
FOR AN 18 YEAR OLD
(IN DOLLARS)

WHITE FEMALES

0 - 8 YEARS EDUCATION

DISABILITY/AGE	15-24	25-34	35-44	45-54	55+
SENSORY	2,348	3,217	3,079	2,895	1,367
ORTHO/AMPUT	3,066	3,836	5,996	5,760	4,032
MENTAL ILL	4,042	4,979	5,927	6,674	5,319
OTHER	3,216	4,205	5,184	5,667	4,428

9 - 12 YEARS EDUCATION

DISABILITY/AGE	15-24	25-34	35-44	45-54	55+
SENSORY	5,528	5,474	6,187	5,744	2,415
ORTHO/AMPUT	6,192	6,777	6,632	8,720	6,474
MENTAL ILL	5,571	7,085	8,755	9,816	9,696
OTHER	5,595	5,847	7,397	8,319	7,501

13+ YEARS EDUCATION

DISABILITY/AGE	15-24	25-34	35-44	45-54	55+
SENSORY	6,863	8,772	8,419	10,858	3,197
ORTHO/AMPUT	7,670	9,392	11,067	12,987	11,365
MENTAL ILL	6,757	8,816	11,261	13,142	12,711
OTHER	7,283	8,719	11,022	13,109	13,094

BLACK FEMALES

0 - 8 YEARS EDUCATION

DISABILITY/AGE	15-24	25-34	35-44	45-54	55+
SENSORY	2,403	3,101	3,232	2,394	1,655
ORTHO/AMPUT	2,244	4,383	5,093	5,291	2,931
MENTAL ILL	3,946	4,928	5,976	4,986	5,497
OTHER	3,528	4,324	5,353	5,062	4,990

9 - 12 YEARS EDUCATION

DISABILITY/AGE	15-24	25-34	35-44	45-54	55+
SENSORY	5,104	4,987	5,281	3,758	2,146
ORTHO/AMPUT	6,337	6,571	7,593	6,670	5,617
MENTAL ILL	5,323	6,575	7,572	8,110	9,100
OTHER	5,184	5,896	7,034	7,187	6,968

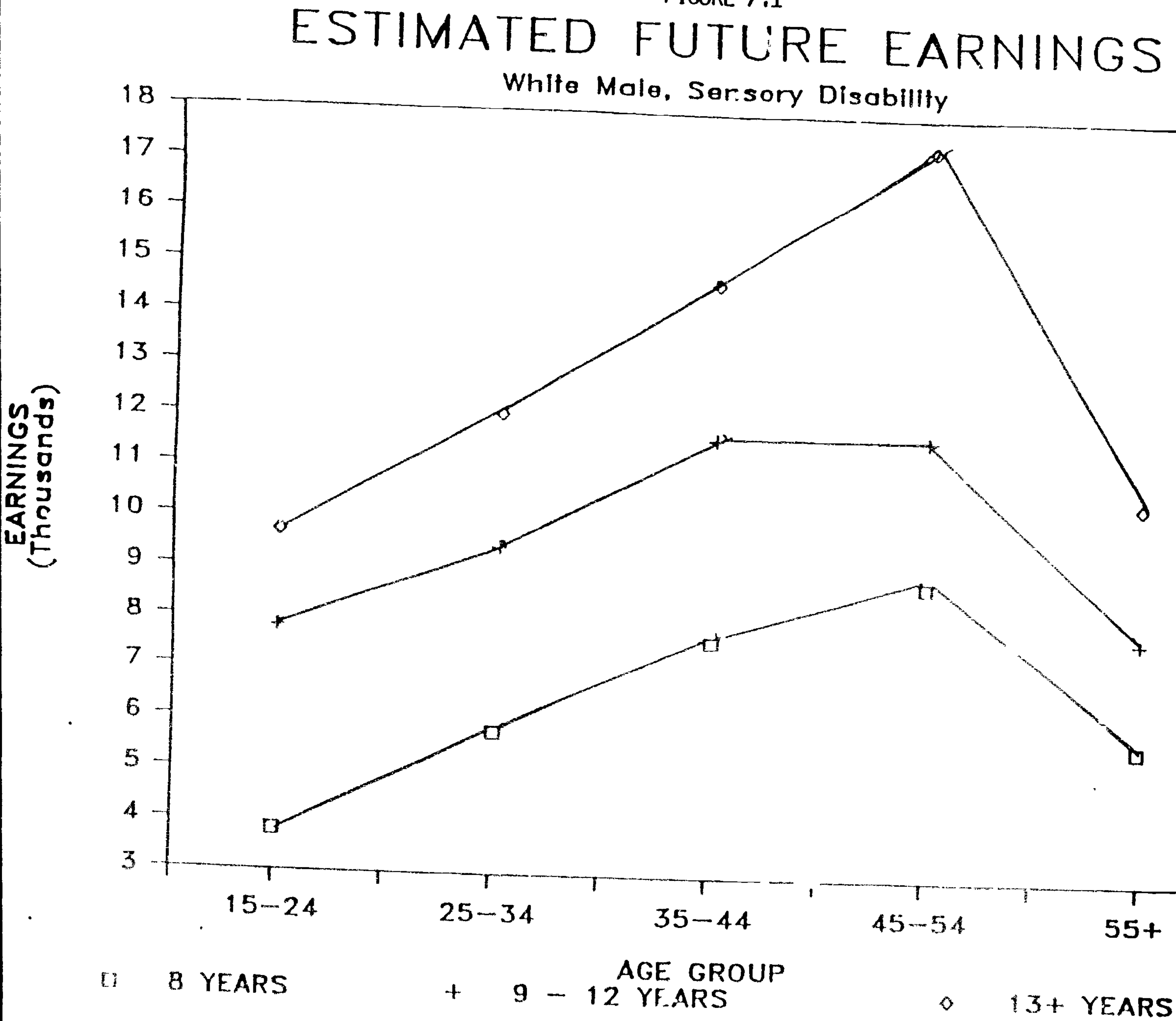
13+ YEARS EDUCATION

DISABILITY/AGE	15-24	25-34	35-44	45-54	55+
SENSORY	5,923	8,118	11,136	8,988	3,729
ORTHO/AMPUT	7,280	8,367	10,670	10,258	6,654
MENTAL ILL	6,568	7,916	9,833	11,021	14,302
OTHER	6,363	7,136	10,346	11,473	8,112

MENTAL RETARD

COHORT/AGE	15-24	25-34	35-44	45-54	55+
WHIE MALE	4,155	4,249	4,333	4,059	4,743
BLACK MALE	4,993	5,355	5,976	7,204	6,457
WHITE FEMALE	2,858	3,003	3,327	3,450	2,943
BLACK FEMALE	3,257	4,222	4,969	5,666	5,088

FIGURE 7.1


ESTIMATED FUTURE EARNINGS
White Male, Sensory Disability
EARNINGS (Thousands)
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
15-24
25-34
35-44
45-54
55+
AGE GROUP
8 YEARS
9 - 12 YEARS
13+ YEARS

discount rate. This measure of benefits is denoted as ben4.

We regressed these benefit values on the same set on independent variables in Table 7.1. The results of these regression are reported in Tables 7.8. To compute the estimated benefits for an individual with a particular set of characteristics, the coefficients of the selected characteristics are added or subtracted to the intercept value. This yields the value of B_s which will be used in the benefit cost ratio.

To calculate the expected lifetime benefits we simply multiply P_s, the probability of success, by B_s, the estimated benefit. This is the numerator of the benefit cost ratio. The expected cost of a client, the denominator of the benefit cost ratio, is simply $P_s(C_s) + (1-P_s)C_n$. Dividing the numerator by the denominator yields the benefit cost ratio. Selected benefit cost ratios of our three models are reported in Tables 7.9, 7.10 and 7.11.

Our tentative conclusion is that these adjustments may improve the calculation of benefit cost ratios but that they do not solve the problem of providing an unambiguous measure that would be widely accepted. The benefit costs ratios we calculated are very sensitive to the assumptions concerning zero wages at referral and to the specification of the productivity grtowth rate and social discount rate.

The weighted average of the strat fied benefit cost ratios derived using the first measure of benefits range from a ratio

Table 7.8

RESULTS OF
BENEFIT REGRESSIONS

VARIABLE CODE	BEN1.11	BEN1.12	BEN1.21	BEN1.22	BEN2.11	BEN2.12	BEN2.21	BEN2.22	BEN4
AGE 00 (basis)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AGE 25	-10387.4	-7613.9	-11407.5	-8205.3	-3250.3	-2368.1	3575.9	-2556.0	-34104.1
AGE 35	-17341.3	-12003.8	-19300.4	-13148.9	-5781.4	-4057.2	-6411.4	-4427.7	-45800.1
AGE 45	-32527.6	-23495.6	-35683.9	-25487.1	-13911.2	-10663.7	-15017.7	-11384.8	-67388.3
AGE 55	-51990.4	-40388.7	-55869.0	-42989.2	-19255.8	-15461.4	-20509.1	-16311.1	-71690.4
SEXF (basis)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SEXM	17551.3	14642.3	18463.9	15304.9	377.3	409.9	359.4	403.9	30024.0
RACEB (basis)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RACEW	3405.4	2886.5	3564.4	3005.4	-3697.5	-2973.0	-3935.3	-3135.8	7431.0
ED8 (basis)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ED9	13211.2	11038.8	13893.6	11532.9	3730.7	3058.1	3946.3	3210.5	8725.6
ED13	22300.1	18700.6	23418.2	19523.1	4380.2	3621.2	4620.5	3793.7	31163.0
HRET (basis)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SENSORY	2650.7	1399.2	3103.6	1674.4	-11687.5	-9768.8	-12295.9	-10203.0	-31964.3
ORTHO/AMPUT	20241.4	16407.4	21478.1	17275.4	-2243.7	-1736.6	-2421.3	-1847.3	14494.0
MILL	17002.4	13852.5	18011.4	14567.3	4700.2	-3678.9	-5048.6	-3904.8	43179.1
OTHER	12548.6	10083.0	13355.4	10637.9	-5938.4	4713.6	6316.4	-4987.5	27167.2
INTERCEPT	32928.3	25988.3	35262.5	27532.8	26733.8	21448.[illegible]	28480.3	22632.3	20161.3

Table 7.9
BENEFIT COST RATIOS
(BEN1.12)

DISABILITY/AGE	WHITE MALES 14-24	25-34	35-44	45-54	55+	BLACK MALES 14-24	25-34	35-44	45-54	55+
0 - 8 YEARS EDUCATION										
SENSORY	5.96	5.87	5.60	3.93	1.16	5.56	5.47	5.21	3.52	0.46
ORTHO/AMPUT	7.69	8.08	8.09	6.74	5.20	7.23	7.66	7.74	6.42	4.86
MENTAL ILL	9.51	10.81	11.34	9.83	8.82	9.14	10.72	11.58	10.27	10.15
MENTAL RET	9.47	10.30	10.39	8.40	5.91	9.31	10.35	10.60	8.56	5.86
OTHER	6.69	6.81	6.59	4.61	1.07	6.41	6.5[illegible]	6.41	4.33	0.10
9 - 12 YEARS EDUCATION										
SENSORY	8.36	8.72	8.62	6.92	4.82	7.86	8.43	8.38	6.48	18.39
ORTHO/AMPUT	10.38	11.37	11.66	10.36	10.00	9.71	11.14	11.58	9.92	10.40
MENTAL ILL	13.47	16.37	17.87	16.96	22.33	12.75	17.23	19.67	17.58	37.52
MENTAL RET	13.18	15.23	15.91	14.10	14.75	12.98	16.02	17.16	14.75	18.75
OTHER	9.56	10.41	10.50	8.54	6.11	9.20	10.56	10.83	8.41	6.20
13+ YEARS EDUCATION										
SENSORY	9.49	10.00	9.97	8.37	6.90	9.36	9.79	9.82	8.39	20.04
ORTHO/AMPUT	11.47	12.58	12.90	11.67	11.80	11.46	12.43	12.90	12.20	12.36
MENTAL ILL	14.61	17.49	18.86	17.96	22.95	15.38	18.33	20.45	22.14	32.34
MENTAL RET	14.37	16.53	17.21	15.57	16.99	15.00	17.37	18.47	17.70	20.78
OTHER	10.69	11.69	11.84	10.06	8.55	10.93	11.91	12.24	10.83	9.12

DISABILITY/AGE	WHITE FEMALES 14-24	25-34	35-44	45-54	55+	BLACK FEMALES 14-24	25-34	35-44	45-54	55+
0 - 8 YEARS EDUCATION										
SENSORY	4.04	3.56	3.08	1.22	-2.48	3.69	3.17	2.67	-2.45	1.04
ORTHO/AMPUT	5.89	5.84	5.59	3.97	1.24	5.53	5.49	5.27	0.38	5.25
MENTAL ILL	7.09	7.46	7.37	5.23	1.04	6.80	7.31	7.33	-0.17	9.45
MENTAL RET	5.00	4.58	4.00	1.40	-4.52	4.71	4.26	3.64	-4.21	1.20
OTHER	5.92	5.79	5.42	3.38	-0.44	5.67	5.56	5.21	-1.03	4.54
9 - 12 YEARS EDUCATION										
SENSORY	6.15	5.99	5.62	3.68	-2.93	5.84	5.69	5.32	-0.43	4.82
ORTHO/AMPUT	8.25	8.65	8.58	6.93	1.48	7.97	8.45	8.46	2.95	10.32
MENTAL ILL	10.39	11.83	12.28	10.27	1.44	10.38	12.30	13.16	4.30	25.79
MENTAL RET	7.86	8.14	7.82	5.11	-5.79	7.78	8.20	7.94	-1.22	9.08
OTHER	8.55	9.00	9.85	6.77	-0.54	8.48	9.08	9.03	1.94	10.94
13+ YEARS EDUCATION										
SENSORY	7.25	7.27	6.97	5.15	-2.81	6.99	7.02	6.75	1.22	6.97
ORTHO/AMPUT	9.31	9.85	9.83	8.29	1.40	9.08	9.72	9.78	4.53	12.15
MENTAL ILL	11.56	13.13	13.61	11.82	1.23	11.61	13.64	14.49	6.63	25.45
MENTAL RET	9.13	9.65	9.46	7.04	-5.21	9.13	9.84	9.74	1.44	12.23
OTHER	9.66	10.27	10.20	8.29	6.01	9.64	10.43	10.46	3.89	13.02

Table 7 10
BENEFIT COST RATIOS
(BEN2.21)

WHITE MALE / BLACK MALES

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
WHITE MALE — 0 - 8 YEARS EDUCATION					
SENSORY	1.21	1.06	0.86	-0.28	-1.63
ORTHO/AMPUT	2.20	2.28	2.21	1.20	0.45
MENTAL ILL	2.52	2.79	2.79	1.32	-0.13
MENTAL RET	2.50	2.64	2.53	0.98	-0.58
OTHER	2.90	3.13	3.10	1.89	1.17
9 - 12 YEARS EDUCATION					
SENSORY	1.82	1.77	1.59	0.32	-1.02
ORTHO/AMPUT	2.95	3.20	3.19	2.08	1.55
MENTAL ILL	3.60	4.28	4.50	2.87	2.23
MENTAL RET	3.51	3.97	3.98	2.25	1.08
OTHER	3.85	4.34	4.41	3.10	2.80
13+ YEARS EDUCATION					
SENSORY	1.90	1.65	1.68	0.43	-0.81
ORTHO/AMPUT	3.03	3.26	3.24	2.14	1.64
MENTAL ILL	3.62	4.21	4.35	2.79	2.17
MENTAL RET	3.54	3.94	3.92	2.27	1.24
OTHER	3.87	4.31	4.35	3.08	2.76

BLACK MALES	14-24	25-34	35-44	45-54	55+
0 - 8 YEARS EDUCATION					
SENSORY	1.60	1.55	1.39	0.27	-0.94
ORTHO/AMPUT	2.55	2.75	2.76	1.81	1.36
MENTAL ILL	3.05	3.62	3.85	2.49	1.96
MENTAL RET	3.15	3.55	3.59	2.04	0.96
OTHER	3.45	3.89	3.99	2.83	2.59
9 - 12 YEARS EDUCATION					
SENSORY	2.24	2.37	2.26	0.98	5.25
ORTHO/AMPUT	3.31	3.83	3.95	2.78	2.90
MENTAL ILL	4.13	5.61	6.31	4.42	8.62
MENTAL RET	4.25	5.28	5.57	3.68	4.16
OTHER	4.43	5.40	5.69	4.25	5.20
13+ YEARS EDUCATION					
SENSORY	2.42	2.46	2.35	1.14	5.18
ORTHO/AMPUT	3.59	3.90	3.99	3.05	2.89
MENTAL ILL	4.58	5.43	5.93	4.96	6.25
MENTAL RET	4.49	5.17	5.38	3.89	3.80
OTHER	4.69	5.32	5.54	4.48	4.82

WHITE FEMALES / BLACK FEMALES

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
WHITE FEMALES — 0 - 8 YEARS EDUCATION					
SENSORY	1.16	1.00	0.78	-0.35	-1.66
ORTHO/AMPUT	2.18	2.23	2.13	1.11	0.32
MENTAL ILL	2.46	2.64	2.58	1.12	-0.29
MENTAL RET	3.20	3.47	3.42	2.04	1.18
OTHER	2.09	2.10	1.95	0 68	-0.53
9 - 12 YEARS EDUCATION					
SENSORY	1.75	1.67	1.48	0.23	-1.96
ORTHO/AMPUT	2.90	3.09	3.05	1.93	0.39
MENTAL ILL	3.45	3.97	4.06	2.44	-0.41
MENTAL RET	4.24	4 83	4.90	3.39	1.52
OTHER	2.88	3.07	2.97	1.57	-0.64
13+ YEARS EDUCATION					
SENSORY	1.82	1.75	1.56	0.34	-1.88
ORTHO/AMPUT	2.96	3.14	3.08	1.98	0.37
MENTAL ILL	3.47	3.91	3.95	2.42	-0.35
MENTAL RET	4.24	4.77	4.80	3.34	1.36
OTHER	2.91	3.08	2.98	1.63	0.67

BLACK FEMALES	14-24	25-34	35-44	45-54	55+
0 - 8 YEARS EDUCATION					
SENSORY	1.57	1.49	1.33	-0.71	0.27
ORTHO/AMPUT	2.57	2.74	2.71	0 81	2.51
MENTAL ILL	3.03	3.49	3.61	0.71	4.11
MENTAL RET	3.89	4.43	4.52	1.75	5.19
OTHER	2.63	2.81	2.74	0.31	2.19
9 - 12 YEARS EDUCATION					
SENSORY	2.24	2.28	2.15	[illegible]16	1.32
ORTHO/AMPUT	3.40	3.7[illegible]	3.82	1.65	4.17
MENTAL ILL	4.25	5.25	5.68	2.20	9.57
MENTAL RET	5.15	6.17	6.49	3.28	9.29
OTHER	3.56	4.00	4.05	1.25	4.23
13+ YEARS EDUCATION					
SENSORY	2.32	2.36	2.23	-0.03	1.43
ORTHO/AMPUT	3.47	3.81	3.84	1.72	4.09
MENTAL ILL	4.24	5.09	5.40	2.17	7.79
MENTAL RET	5.12	6.02	6.26	3.22	8.31
OTHER	3.58	3.98	3.99	1.32	4.03

Table 7.11
BENEFIT COST RATIOS
(BEN4)

WHITE MALES

0 - 8 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	3.40	-1.33	-3.43	-7.67	-11.84
ORTHO/AMPUT	9.25	5.87	4.44	0.87	0.11
MENTAL ILL	16.71	14.48	13.75	9.70	15.12
MENTAL RET	14.98	11.35	9.73	4.85	5.86
OTHER	8.85	4.46	2.47	-2.25	-4.80

9 - 12 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	5.13	0.05	-2.24	-7.04	-11.56
ORTHO/AMPUT	11.82	8.38	6.93	2.94	2.99
MENTAL ILL	21.57	20.31	20.19	15.91	30.15
MENTAL RET	19.07	15.87	14.42	8.95	13.27
OTHER	11.63	7.15	5.07	-0.29	-2.31

13+ YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	8.47	4.06	2.13	-2.21	-4.42
ORTHO/AMPUT	15.06	12.25	11.13	7.60	9.74
MENTAL ILL	25.34	25.01	25.36	22.06	38.77
MENTAL RET	23.04	20.91	20.02	15.49	23.56
OTHER	15.25	11.70	10.14	5.56	6.70

BLACK MALES

0 - 8 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	2.41	-2.52	-4.79	-9.34	-14.89
ORTHO/AMPUT	8.20	4.74	3.25	-0.52	-2.05
MENTAL ILL	15.66	13.55	12.97	8.61	15.60
MENTAL RET	14.21	10.39	8.64	3.13	3.21
OTHER	7.91	3.21	0.98	-4.35	-8.71

9 - 12 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	3.99	-1.33	-3.85	-8.86	9.34
ORTHO/AMPUT	10.47	7.24	5.70	1.34	0.64
MENTAL ILL	19.86	20.22	20.69	14.52	45.39
MENTAL RET	18.10	15.38	13.90	7.21	12.63
OTHER	10.49	5.94	3.58	-2.53	-7.03

13+ YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	7.61	2.82	0.72	-4.06	16.30
ORTHO/AMPUT	14.50	11.26	10.13	6.65	8.44
MENTAL ILL	26.16	25.27	26.32	25.46	52.11
MENTAL RET	23.45	20.91	20.17	15.86	26.37
OTHER	14.98	10.88	9.20	4.22	4.65

WHITE FEMALES

0 - 8 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	-0.58	-6.04	-8.45	-12.96	-18.67
ORTHO/AMPUT	5.48	1.24	-0.62	-4.61	-7.47
MENTAL ILL	11.74	7.80	5.99	0.92	-0.41
MENTAL RET	4.78	-1.40	-4.31	-10.37	-17.29
OTHER	8.32	3.81	.80	-2.76	-5.24

9 - 12 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	0.65	-5.29	-7.95	-13.03	-22.03
ORTHO/AMPUT	7.44	2.97	0.97	-3.50	-8.96
MENTAL ILL	15.37	11.64	9.91	4.11	-0.57
MENTAL RET	7.16	0.56	-2.66	-9.68	-22.19
OTHER	10.86	6.24	4.12	-1.00	-6.39

13+ YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	3.97	-1.28	-3.58	-8.20	-21.15
ORTHO/AMPUT	10.66	6.84	5.19	1.20	-8.49
MENTAL ILL	19.18	16.54	15.45	10.77	-0.48
MENTAL RET	11.28	5.95	3.45	-2.52	-19.95
OTHER	14.39	10.63	8.96	4.50	4.95

BLACK FEMALES

0 - 8 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	-1.59	-7.36	-10.01	-15.72	-21.09
ORTHO/AMPUT	4.52	0.09	-1.93	-7.06	-9.09
MENTAL ILL	10.82	6.63	4.62	-2.58	-2.34
MENTAL RET	3.66	-3.23	-6.67	-15.05	-22.71
OTHER	7.44	2.59	0.33	-5.84	-7.24

9 - 12 YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	-0.47	-6.86	-9.84	-16.42	-22.77
ORTHO/AMPUT	6.47	1.71	-0.49	-6.41	-8.28
MENTAL ILL	14.71	10.79	8.89	0.15	4.41
MENTAL RET	6.07	-1.45	-5.37	-15.54	-25.84
OTHER	10.09	5.04	2.64	-4.51	-5.25

13+ YEARS EDUCATION

DISABILITY/AGE	14-24	25-34	35-44	45-54	55+
SENSORY	2.94	-2.69	-5.23	-11.22	-14.81
ORTHO/AMPUT	9.79	5.76	3.99	-1.28	-0.51
MENTAL ILL	18.74	16.17	15.16	8.33	19.69
MENTAL RET	10.49	4.57	1.65	-6.83	-9.27
OTHER	13.82	9.81	8.00	[illegible]	[illegible]

of 9 to 1 to a ratio of 12 to 1. As stated earlier, these ratios are exaggerated since they tend to overestimate the wage gain of rehabilitants.

In the second measure of benefits, the average benefit cost ratios ranged from 3 to 1 to a ratio of 4 to 1, depending on the discount and productivity rates used. By assigning the mean wage to those clients who reported a zero wage at referral, this measure of benefit may underestimate the wage gain of rehabilitants.

In the last measure of benefits, where we used the age-earnings profiles to project benefits, the overall average was approximately 8 to 1.

However, these ratios are only rough averages of the benefits and costs of the Vocational Rehabilitation program. If the objective is to measure the efficiency of the program--to determine if the expenditure of the marginal dollar yields more than a dollar of benefits--these measures fall short. Such a conclusion comes as no surprise since it is the same conclusion reached earlier in our examination of the models.

Chapter 8

CORRECTING FOR ZERO WAGES AT REFERRAL

Anita G. Hall-Kane*

Ronald Conley has pointed out that a "striking measure of the economic value of the rehabilitation program is obtained by comparing the increase in estimated annual earnings of rehabilitants between time of acceptance and time of closure relative to the costs of the program," [7, p.55]. However, before a meaningful comparison can be made a persistent problem in vocational rehabilitacion (VR) data, the lack of earnings data recorded at the time of acceptance, must be acknowledged and resolved.

During the fourteen year period from 1945 to 1958 on average 88 percent of all accepted cases did not report earnings at acceptance (See Table 1). In the following years numerous attempts were made to alleviate this missing data problem. In the hopes of capturing more information upon which to measure improvements in earnings as a result of VR, over the next five years the Rehabilitation Services Administration (RSA) would alter the time period before acceptance, within which to measure earnings. By lengthening this time period it might be possible to capture work histories of otherwise non-reporting clients.

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The danger of this approach is a period too lengthy might include earnings by rehabilitants prior to onset of their disabling condition. A time period too brief would fail to take into account a client's work history if the client were unemployed at acceptance due to their disabling condition. As Conley states "presumably there is an optimal period where the errors would just offset each other, but we have no way of knowing what this optimal period is" [7, p.69].

In 1939 and 1960 VR clients were requested to report their total earnings 12 months prior to acceptance. In addition, "cases for whom no earnings were reported were assumed to have the same proportion with earnings and the same average earnings as all other rehabilitants before and after services"[1] [7, p. 57]. As a result, the combined effects of requesting client earnings 12 months prior to acceptance and imputing earnings to the non-reporting clients helps to explain the over four-fold increase in the percentage of the accepted clients reporting earnings at acceptance, [See Table 1].

During 1961-1963 the RSA again changed the time period for reporting earnings at acceptance. For these three years, clients were requested to report their earnings for the three months prior to acceptance, as opposed to 12 months prior as in 1959 and 1960. The percentage of clients reporting earnings at acceptance dropped by over 50 percent. In 1961, the RSA officially adopted

Table 1

Percentage of VR Clients Reporting Earnings At Acceptance
1945 - 1963

Year	Number of Cases Accepted	Number with Earnings at Acceptance	Percent
1945	86,826	10,056	11.58%
1946	80,380	8,770	10.91%
1947	66,692	10,420	15.17%
1948	88,357	12,337	13.95%
1949	99,202	12,626	12.73%
1950	92,009	11,938	12.97%
1951	90,603	11,512	12.71%
1952	88,922	11,241	12.64%
1953	84,397	10,946	12.97%
1954	78,045	9,622	12.33%
1955	82,269	9,331	11.34%
1956	93,555	10,421	11.14%
1957	104,125	11,863	11.39%
1958	113,855	13,006	11.42%
1959	121,559	63,011	51.84%
1960	126,839	68,760	54.21%
1961	140,476	29,044	20.68%
1962	148,763	32,361	21.75%
1963	160,611	31,725	19.75%

Source: Derived from Conley [7, p. 54, 57]
Tables 4-1, and 4-3

the practice of imputing an earnings value for all clients reporting no earnings at acceptance, based on the average earnings of all other clients [7, p. 59]. Conley reports "the effect of this practice on the estimated annual rise in earnings was insignificant in 1961. In 1962 it depressed the estimated annual rise in earnings by about $2 million, because of the greater numbers for whom data were not reported at acceptance." [7, p. 59].

Since 1964 the RSA has been requesting earnings for one week prior to the date of acceptance.

<u>The Problem</u>

Given that a change in the earnings of rehabilitants between the time of referral and closure is an acceptable, but less than perfect, criterion to evaluate the economic impact of the VR program, at least three problems arise when a VR client reports no weekly earnings at referral.

First, from the perspective of the VR program, how much of a positive impact on earnings can be attributed to VR participation when a client reports zero earnings at acceptance into the program and positive earnings at closure? Using 100 percent of the difference between weekly earnings at referral and at closure to evaluate the economic impact of the VR program assumes that: [7]

- the client's earnings actually represents all of the benefit of their participation in the VR program

- the client's pre-program earnings would have remained unchanged in the absence of VR participation

- clients designated as non-successful rehabilitants receive no significant impact on their earnings as a result of being in the VR program

- the level of rehabilitant's earnings at closure will be constant over the remaining measurement period.

If these are unacceptable assumptions how can we separate the improvement in earnings attributable to VR participation from the improvement due to previously obtained skills or knowledge?

Second, from a human capital perspective, if a client reports zero weekly earnings at referral, should that value be accepted as representative of the actual market value of their stock of human capital? If the market value of a client's stock of human capital (i.e. weekly earnings) represents the value of their marginal product, can it truly be the case that a rehabilitant has so little human capital to offer in the market to warrant zero earnings? Should a minimum value of human capital be assumed for each client reporting zero earnings at acceptance?

Lastly, clients reporting zero weekly earnings at acceptance pose econometric problems. One solution to the problem is to estimate their expected earnings (if working) based on the information reported by clients who are reported as working at referral. However, in general, it is unacceptable simply to run a regression on a sample of clients working at referral and then apply the resulting coefficients to clients not working at

referral to impute an earnings figure for them. There are likely to be unmeasurable characteristics that influence both the work-not work decision and the measured earnings if working. If these are not accounted for, biased estimates are likely.

The presence (or absence) of a client's reported weekly earnings at acceptance can be modelled by a jointly determined decision criterion. This decision criterion simultaneously optimizes a labor force participation choice and a labor supply decision.

The labor force participation choice is specified as:

$$(1) \qquad P_i = Pr(D_i = 1) = f(X_{4i}, U_{4i})$$

where P_i = probability of labor force participation

X_{4i} = a matrix of exogeneous variables

U_{4i} = a normally distributed random variable which captures the effects of unmeasurable variables

D_i = 1 if participating in the labor force

D_i = 0 if not participating in the labor force

The probability that client i is in the labor force, P_i is a function of various exogeneous variables X_{4i}, such as education, sex, age, family income, and a random variable, U_{4i}.

The labor supply decision is modeled in an earnings equation form. A client's earnings equation is specified as:

(2) $$Y_i = f(X_{2i}, U_{2i})$$

where Y_i = client's weekly earnings

X_{2i} = a matrix of exogeneous variables

U_{2i} = a normally distributed random variable which captures the effects of unmeasurable variables

The presence of earnings at acceptance is also a function of various exogeneous variables, X_{2i}, not necessarily mutually exclusive from the exogeneous variables in the participation model, X_{4i}, and a random variable, U_{2i}. The random variables U_{2i} and U_{4i} are generally modelled to be correlated. Correlated exogeneous variables pose no problems in estimation. However, correlated unmeasurable variables pose serious problems. As mentioned in a previous paragraph, if the correlation between U_{2i} and U_{4i} is not accounted for, OLS estimation of equation (2) will produce biased coefficients and lead to biased estimates of benefits in further analysis.

The Theoretical Model

One solution to correct the zero weekly earnings at referral problem is to treat earnings within a censored sample framework. Heckman [13] introduced a method to generate consistent estimators using a two-stage technique for censored samples.

The sample is censored because nearly complete information is available for each client with the exception of those individuals who report zero weekly earnings at acceptance which

is the dependent variable. These clients are defined to have "censored" weekly earnings at acceptance. Heckman posits a method to impute earnings to these clients which revolves around unmeasurables, represented by the error term in regression equations. If the errors in the earnings function and the participation equation are correlated then a sample selection-bias problem exists. Regressions estimated using a sample of clients with positive earnings at referral will not constitute a random sample. Regression equations based on a non-random sample will bias the estimated coefficients and therefore will lead to biased estimates of the imputed earnings of non-reporting clients.

To alleviate these problems, the influence of an error term on work status and subsequently on the availability of the earnings data and the selection-bias problem, the model can be recharacterized within a specification error framework.

By using a subset of data from clients reporting positive earnings at referral, I am selecting a non-random sample. I can identify observations for inclusion in the sample by the sample selection rule. Using this subset of data from clients reporting positive earnings data, I can specify a function including a sample selection rule such as:

(3) $$E[Y_i^{ref} \mid X_{2i}, \text{sample selection rule}]$$

$$= X_{2i} B_2 + E[U_{2i} \mid \text{sample selection rule}]$$

where Y_i^{ref} = the weekly earnings at referral of client i as determined by the market

X_{2i} = a k x i matrix of all observable exogeneous variables

B_2 = a k x 1 vector of generated coefficients

U_{2i} = the earnings error term for client i

If the expectation of U_{2i} conditional upon the sample selection rule is zero then the selected sample will meet all the requirements for consistent OLS estimates. However, this is generally not the case.

Let the client's weekly earnings reported at referral, Y_i^{ref} be a function of a vector of exogeneous (measurable) variables, X_{2i}, and an unmeasurable variable, U_{2i}. And let the client's reservation earnings, Y_i^{res} also be a function of a vector of exogeneous (measurable) variables, X_{3i}, and an unmeasurable variable, U_{3i}.

(4a) $$Y_i^{ref} = X_{2i} B_2 + U_{2i}$$

(b) $$Y_i^{res} = X_{3i} B_3 + U_{3i}$$

where B_n is a vector of paramters, n = 2,3

If a client is reported as working, then $Y_i^{ref} > 0$ and $Y_i^{ref} > Y_i^{res}$ and $Y_i^{ref} - Y_i^{res} > 0$. The market earnings Y_i^{ref}, will be

observed but Y_i^{res} will not be observed. For VR clients at referral, I propose a sample selection rule as follows:

Assuming every client stated as working at program acceptance will also report positive earnings at acceptance, then the Pr(working at referral) = $Pr(D_i = 1)$

$$= Pr(Y_i^{ref} > Y_i^{res})$$

$$= Pr(Y_i^{ref} - Y_i^{res} > 0)$$

and conversely,

Pr(not workin referral) = $1 - Pr(D_i = 1)$

$$= 1 - Pr(Y_i^{ref} > Y_i^{res})$$

where Y_i^{res} represents the client reservation earnings

The client will be drawn into the labor force if the offered value of time in the labor force is greater than the value of time out of the labor force. This is more commonly expressed as the condition that the offered market earnings exceed the client's reservation earnings. Let the probability that Y_i^{ref} is greater than Y_i^{res} be denoted as

$$(5) \qquad P_i = Pr(D_i = 1) = Pr(Y_i^{ref} > Y_i^{res})$$

$$= Pr(Y_i^{ref} - Y_i^{res} > 0)$$

$$= \Pr[(X_{2i}B_2 + U_{2i}) - (X_{3i}B_3 + U_{3i}) > 0]$$

$$= \Pr[(X_{2i}B_2 - X_{3i}B_3) > (U_{3i} - U_{2i})]$$

$$= \Pr[X_{4i}B_4 > U_{4i}] = \Pr[U_{4i} > -X_{4i}B_4]$$

(5) and $1 - P_i = 1 - \Pr(D_i = 1)$ otherwise.

where P_i represents the labor force participation choice.

$D_i = 1$ indicates a client is participating in the labor force

$D_i = 0$ otherwise

X_{4i} = the union of X_{3i} and X_{2i}

$U_{3i} - U_{2i} = U_{4i}$

$$\begin{bmatrix} U_{2i} \\ U_{4i} \end{bmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix} \begin{pmatrix} \sigma_{22} & \sigma_{24} \\ \sigma_{42} & \sigma_{44} \end{pmatrix}\right]$$

If equation (4a) were estimated on a sample of clients reporting positive earnings at referral using ordinary least squares, biased results are likely to be observed. One of the primary assumptions under which the method of least squares yields consistent estimates is that the expectation of the error term, U_{2i}, conditional on the exogeneous variables be zero for each client; $E[U_{2i}|X_{2i}] = 0$.

Let P_i be a function of a vector of exogeneous variables, X_{4i} and an unmeasurable variable, U_{4i}.

(7) $$P_i = f(X_{4i}, U_{4i})$$

where B_4 is a vector of parameters

Using (3) and (4a,b) I can respecify my equations as:

(8) $$E[Y_i^{ref} | X_{2i}, D_i = 1] = E[X_{2i} B_2 + U_{2i} | D_i = 1]$$
$$= X_{2i} B_2 + E[U_{2i} | D_i = 1]$$
$$= X_{2i} B_2 + E[U_{2i} | U_{4i} > - X_{4i} B_4]$$

In order to continue to use the method of least squares to estimate unbiased parameters for equation (4a) the expectation of the error term, U_{2i}, conditional upon the measurable variables (X_{4i}) and unmeasurable variable (U_{4i}) in equation (8) must be equal to zero;

(9a) $$E[U_{2i} | U_{4i} > - X_{4i} B_4] = 0.$$

In general it is not the case that the expected value of U_{4i} in (7) be zero. It is not unreasonable to expect that U_{2i} and U_{4i} be correlated. In fact, it has been shown that: [12, 13]

(b) $$E[U_{2i} | U_{4i} > - X_{4i} B_4] = \frac{\sigma_{24}}{(\sigma_{44})^{½}} \lambda_i$$

(c) $$E[U_{4i} \mid U_{4i} > -X_{4i}B_4] = \frac{\sigma_{44}}{(\sigma_{44})^{1/2}}$$

where

$$\lambda_i = \frac{\phi(Z_i)}{1 - \Phi(Z_i)} \qquad Z_i = \frac{-X_{4i}B_4}{(\sigma_{44})^{1/2}}$$

As shown in Graph 1, λ_i is the ratio of the ordinate of a standard normal and the tail area of the distribution. The tail area represents the probability that a population observation with characteristics X_{4i} will be selected into the observed sample.[13, p.479].

Continuing on with the stated objective of estimating equation (4a) it can now be rewritten as the following:

(10) $$Y_i^{ref} = X_{2i}B_2 + \frac{\sigma_{24}}{(\sigma_{44})^{1/2}}\lambda_i + V_{2i}$$

from

$$E[Y_i^{ref} \mid X_{2i}, V_{2i}, D_i = 1]$$

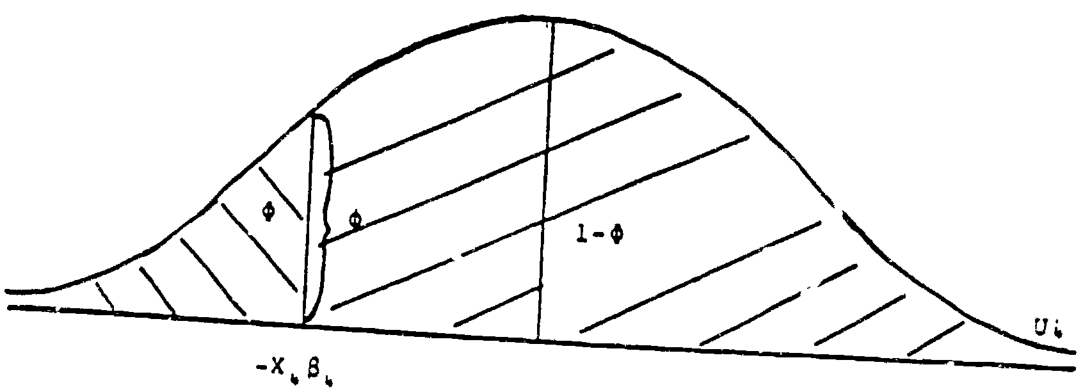
$$= X_{2i}B_2 + E[U_{2i} \mid U_{4i} > -X_{2i}B_4] + E[V_{2i} \mid X_{2i}, \lambda_i, U_{4i} > -X_{4i}B_4]$$

$$= X_{2i}B_2 + \frac{\sigma_{24}}{(\sigma_{44})^{1/2}}\lambda_i$$

In order to use OLS on equation (10) it must be shown that the expected value of the new error term V_{2i}, conditional upon the other variables be equal to zero;

Graph 1

A Probability Density Function For U_4



(11) $\quad$ Let $V_{2i} = U_{2i} - \dfrac{\sigma_{24}}{(\sigma_{44})^{1/2}} \lambda_i$

Using (11) equation (10) can be respecified as:

(12)
$$E[(U_{2i} - \frac{\sigma_{24}}{(\sigma_{44})^{1/2}} \lambda_i) \mid X_{2i}, \lambda_i, U_{4i} > -X_{4i}B_4]$$
$$= E[U_{2i} \mid X_{2i}, \lambda_i, U_{4i} > -X_{4i}B_4]$$
$$- E[\frac{\sigma_{24}}{(\sigma_{44})^{1/2}} \lambda_i \mid X_{2i}, \lambda_i, U_{4i} > -X_{4i}B_4]$$
$$= \frac{\sigma_{24}}{(\sigma_{44})^{1/2}} \lambda_i - \frac{\sigma_{24}}{(\sigma_{44})^{1/2}} \lambda_i = 0$$

where the expectation of the left hand side was previously given and the expectation of the right hand side, a constant, is a constant.

Equation (10) demonstrates that the missing data problem in the dependent variable can be respecified within a specification error framework with respect to the explanatory variables and the error term. A likely specification of the earnings equation in the style of equation (4a), for my estimation problem, fails to take into account the correlation of U_{2i} and U_{4i} by omitting $\frac{\sigma_{24}}{(\sigma_{44})^{1/2}}$; as a regressor, and would therefore provide biased coefficients if equation (4a) were estimated by OLS. Equation (10) is purged of any sample selection bias when using the subset of data of clients having positive earnings at referral via the λ_i term

being included as a regressor and by ensuring the new error term V_{2i} has a conditional expected value equal to 0.

The previous exposition of equation (10) and (11) are of no value unless λ_i and Z_i can be explicitly estimated. Heckman [13] has shown for censored samples it is possible to estimate the probability that an observation has missing data so that it is possible to estimate Z_i and therefore λ_i.

In order to estimate the λ_i (via the Z_i's) we must begin with the labor force participation equation. The dependent variable in equation (1), D_i, is set as a 0 - 1 variable and regressed on a vector of exogeneous variables, X_{4i}, and an unmeasurable variable, U_{4i}. After the regression, the predicted values of the dependent variable, $\hat{P}_i$ are constrained to fall inside the interval from 0 to 1. These predicted values are interpreted as the probability that an individual is or is not participating in the labor force, given a vector of exogeneous variables and an unmeasurable variable, hence the 0 to 1 interval constraint.

Recall that for clients participating in the labor force we know:

(13a)
$$P_i = Pr(D_i = 1) = Pr[Y_i^{ref} - Y_i^{res} > 0]$$
$$= Pr[U_{4i} > Z_i]$$
$$= Pr[U_{4i} > -X_{4i}B_4]$$

and conversely for clients not participating in the labor force:

(b) $$1 - P_i = 1 = Pr(D_i = 1) = 1 - Pr[Y_i^{ref} - Y_i^{res} > 0]$$

$$1 - Pr[U_{4i} > -X_{4i}B_4]$$

The maximum likelihood estimation of the probit model determines clients to be in or out of the labor force by comparing their individual values ($Y_i^{ref} = X_{4i}B_4 + U_{4i}$) relative to a threshold level, ($Y_T = X_T B_T + U_T$).

Since the probability of participating in the labor force must fall between 0 and 1, P_i must assume the form of a cumulative distribution function, Φ. Further, by the central limit theorem and by standardizing with respect to the participation equation, Φ is assumed to be distributed standard normally.

More formally, the distribution for clients determined to be in the labor force is:

(14)

$$P_i = Pr(D_i = 1)$$

$$= Pr[U_{4i} > - X_{4i}B_4]$$

$$= Pr\ U_{4i} > - X_{4i}B_4$$

$$= Pr\left[\frac{U_{4i}}{\sigma_{4i}} > - \frac{X_{4i}B_4}{\sigma_{4i}}\right]$$

$$= \int_{\frac{-X_T B_T}{\sigma_T}}^{\infty} \frac{1}{\sqrt{2\pi}\,\sigma_{4i}} e^{\left\{\frac{-U_{4i}-\bar{U}_{4i}}{2\sigma_{4i}}\right\}^2}$$

$$= 1 - \Phi\left(-X_T B_T / \sigma_T\right)$$

where $\bar{U}_{4i} = 0$

and the distribution for those determined to be out of the labor force:

(15)

$$1 - P_i = 1 - Pr(D_i = 1)$$

$$= 1 - Pr\left[\frac{U_{4i}}{\sigma_{4i}} > \frac{-X_{4i} B_4}{\sigma_{4i}}\right]$$

$$= \int_{-\infty}^{\frac{-X_T B_T}{\sigma_T}} \frac{1}{\sqrt{2\pi}\,\sigma_{4i}} e^{\left\{\frac{-U_{4i}-\bar{U}_{4i}}{2\sigma_{4i}}\right\}^2}$$

$$= \Phi\left(-X_T B_T / \sigma_T\right)$$

The liklihood function for the sample is:

$$= \prod_{i \in K} \left\{1 - \Phi\left(-X_T B_T / \sigma_T\right)\right\} \prod_{i \in \bar{K}} \left\{\Phi\left(-X_T B_T / \sigma_T\right)\right\}$$

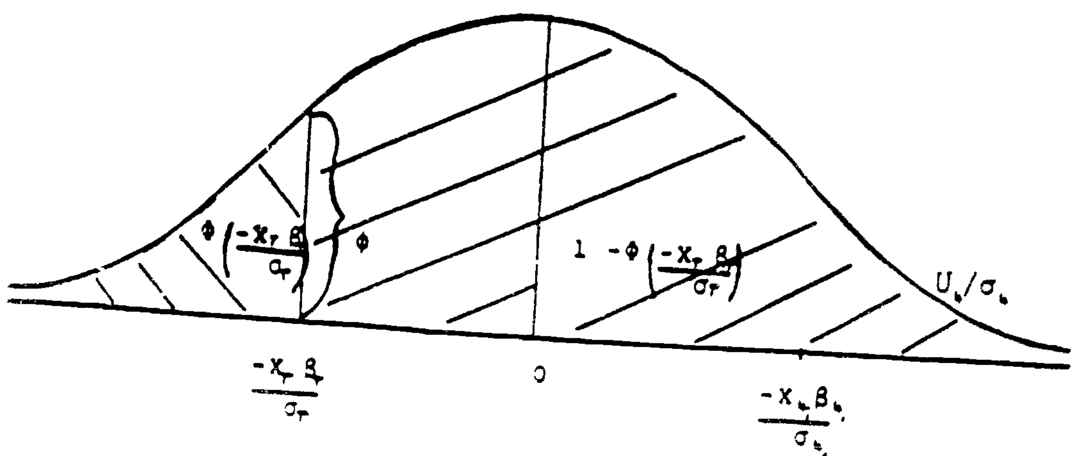
where $i \in K$ represents clients determined to be in the labor force with positive weekly earnings at referral

$i \in \bar{K}$ otherwise

Graph 2 represents the probability density function for participating and non-participating clients. Clients to the

Graph 2

A Standardized Probability
Function for U_i/σ_i



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right of the threshold level $\frac{-X_T B_T}{\sigma_T}$ are considered to be in set K and clients to the left are in set $\bar{K}$.

At $\frac{-X_{4j}B_{4j}}{\sigma_{4j}}$, the height of the probability density function represents the probability client j is included into sample K. This is estimated by

$$(17) \qquad \hat{\lambda}_j = \frac{\phi(-X_{4j}\hat{B}_{4j}/\hat{\sigma}_{4j})}{1 - \Phi(-X_T\hat{B}_T/\hat{\sigma}_T)}$$

Alternatively, a client j' located to the left of $\frac{-X_T B_T}{\sigma_T}$ will have an estimated lambda value of

$$(18) \qquad \hat{\lambda}_j' = \frac{\phi(-X_{4j}\hat{B}_{4j}/\hat{\sigma}_{4j})}{\Phi(-X_T\hat{B}_T/\hat{\sigma}_T)}$$

This represents the probability that client j' will be included into sample $\bar{K}$.

Therefore, via probit analysis it is possible to estimate λ for every working and nonworking client in the sample, and equation (10) can be directly estimated.

The Data

A one percent random sample (N=7193) of clients drawn from the fiscal 1982 national R300 data set (N=720,612) was used in this analysis, [24]. Key variables were tested for representativeness relative to the data set from which they were drawn. As expected for randomly generated samples, no significant differences were found between the population and sample statistics.

Tables 2 and 3 give descriptive statistics of the variables principally used in this chapter. The variable of primary focus in this chapter, weekly earnings at referrral, has only 685 individuals or 9.52 percent of the one percent sample reporting nonzero earnings.

The Empirical Model

In order to apply the theoretical model of this chapter, the economic and statistical specifications of the models must be set forth and examined.

Table 4 lists the definition of each explanatory variable used in the probit and earnings equations. For the earnings equation, client's earnings at referral, the dependent variable is expected to be postitively related to years of schooling, job experience and inversely related to health status, [1, 21, 22]. The more severe the disabling condition reported at referral, the greater the likelihood a of negative impact on earnings capacity. Therefore, I have included a 0-1 variable representing the presence or absence of a severe primary work disabling condition. I expect this variable to be inversely related to earnings.[2] In addition, to measure the cumulative effect of more than one disabling condition on labor force participation and earnings I have included a 0-1 variable to indicate the absence or presence of a secondary disabling condition. I expect this also to be inversely related to client earnings. Lastly, I have split the

Table 2

Variable Means By Sex, by Equation

VARIABLE	MEANS FOR VARIABLES IN THE EARNINGS EQUATIONS BY SAMPLE:		MEANS FOR VARIABLES IN THE LABOR FORCE PARTICIPATION EQUATION BY SAMPLE:	
	MALE N = 238	FEMALE N = 221	MALE N = 2062	FEMALE N = 1565
Years of Schooling	11.43	11.46	10.901	11.08
Age at Referral	34.00	36.99	33.20	35.62
Age at Referral^2	1323.30	1545.50	. .	. .
Race	0.85	0.82	. .	. .
Physical Impairment	0.76	0.79	0.72	0.74
All Other Psychoneurotic and Personality Disorders	0.12	0.14	0.16	0.23
Presence of a Severe Primary Disabling Condtion	0.42	0.33	0.54	0.49
Presence of a Secondary Disabling Condition	0.[illegible]6	0.28	0.28	0.30
Number of Dependents	.	. .	1.08	0.75
$\text{Number of Dependents}^2$	.	. .	3.54	2.00
Presence of Public Assistance Payments Received by the Individual	.	. .	0.16	0.23
Family Income	. .	. .	324.49	337.11
Lambda (Estimated)	1.4242	1.3767	0.18583	0.22437

Source: 1982 National R300 Data Set, (23)

Table 3

Descriptive Statistics of the One Percent Random Sample taken from the National R300 FY1982 Data Set

Variable	N	% of Random Sample
SEX		
Females	2938	40.84%
Males	4117	57.24%
	7193	
RACE		
White	5224	72.63%
Black	1385	19.25%
Other (Indian, Asian, Etc)	128	17.80%
Not Reported	456	6.34%
	7193	
AGE AT REFERRAL		
17 and Under	547	7.60%
18 - 24	1841	25.59%
35 - 44	1914	26.61%
45 - 54	1288	17.91%
55 - 64	948	13.18%
65 and Over	471	6.55%
Not Reported	133	1.85%
	51	0.71%
	7193	
Mean Age	32	
MARITAL STATUS		
Married	1643	22.84%
Widowed	193	2.68%
Divorced	893	12.41%
Separated	435	6.05%
Never Married	2749	38.22%
Not Reported	1280	17.80%
	7193	
HIGHEST GRADE COMPLETED		
1 - 9 Years	1166	16.21%
10 - 11 years	1065	14.81%
12 Years (High School Grad)	2074	28.83%
13 - 15 Years	602	8.37%
16 Years (College Grad)	136	1.89%
Greater than College Grad	56	0.78%
Identification Code XX *	2073	28.82%
Not Reported	31	0.43%
	7193	
Mean Education **	10.9	

* Identification Code XX represents clients with a major or secondary disabling condition of mental retardation.

** The mean education of clients excluding the Identification Code XX clients.

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Table 3 (Continued)

Descriptive Statistics of the One Percent Random Sample taken from the National R300 FY1982 Data Set

Variable	N	% of Random Sample
LEVEL OF MONTHLY FAMILY INCOME*		
$149 OR Less	1570	21.83%
$150 TO 199	308	4.28%
$200 TO 249	318	4.42%
$250 TO 299	281	3.91%
$300 TO 349	260	3.61%
$350 TO 399	218	3.03%
$400 TO 449	296	4.12%
$450 TO 499	195	2.71%
$500 TO 599	341	4.74%
Over $600	1322	18.38%
Not Reported	2084	28.97%
	7193	
CLIENT EARNINGS AT REFERRAL		
$ 1 TO 50	116	1.61%
$51 TO 100	168	2.34%
$101 TO 150	195	2.71%
$151 TO 200	99	1.38%
Over 200	107	1.49%
Others (Not reported, missing and zero)	6508	90.48%
	7193	
REPORTED AS WORKING AT REFERRAL		
Yes	937	13.03%
No	6256	86.97%
	7193	
POSITIVE EARNINGS AT REFERRAL AND REPORTED AS WORKING AT REFERRAL		
Total:		
Yes	661	9.19%
No	6532	90.81%
	7193	
By Sex:		
Yes, Males	346	8.40%*
Yes, Females	307	10.45%*

* Expressed as a percentage of their respective sex

Variable	N	% of Random Sample
PUBLIC ASSISTANCE PAYMENTS RECEIVED		
Yes	1162	16.15%
No	6031	83.85%
	7193	

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Table 3 (Continued)
Descriptive Statistics of the One Percent
Random Sample taken from the
National R300 FY1982 Data Set

Variable	N	% of Random Sample
NUMBER OF DEPENDENTS		
Zero	1812	25.19%
7 - 9	348	4.84%
Not Reported	23	0.32%
	1279	17.78%
	7193	
MAJOR DISABLING CONDITION AS REPORTED AT REFERRAL		
Physical Impairments Codes 100 - 500, 600+	3336	46.38%
Mentral Retardation Codes 500 -520	1415	19.67%
All Other Psychoneurotic and Personality Disorders	868	12.07%
Cause of Disabling Condition Not Known at Referral	1574	21.88%
	7193	
PRIMARY DISABLING CONDITION IS DEFINED AS SEVERE		
Yes	3359	46.70%
No	3834	53.30%
	7193	
SECONDARY DISABLING CONDITION IS EVIDENT		
Yes	5655	78.62%
No	1538	21.38%
	7193	

Table 4

Definitions of Variables Used In The Earnings and Participation Equation

VARIABLE	DEFINITION
Years of Schooling	Highest grade of school completed
Age at Referral	Age of client at program referral
Race	Dummy variable equal to 1 if client is white
Major Disabling Condition: Physical Impairment	Dummy Variable equal to 1 if the "Major Disabling Condition" is 100-500 inclusive or 600 and greater
Mental Retardation	Dummy variable equal to 1 if the "Major Disabling Condition" is between 520 inclusive and 600 exclusive
All Other Psychoneurotic and Personality Disorders	Dummy Variable equal to 1 if the "Major Disabling Condition is between 500 inclusive and 520 exclusive
Presence of a Severe Primary Disabling Condition	Dummy variable is equal to 1 if the Special Federal Program Identifier is greater than or equal to 400
Presence of a Secondary Disabling Condition	Dummy variable equal to 1 if any Secondary Disabling Condition is reported
Number of Dependents	The number of dependents for whom the individual is recognized as the "head of the household"
Presence of Public Assistance Payments Received by the Individual	Dummy variable equal to 1 if Public Assistance Payments are received by the individual
Family Income	The amount of family income for the month prior to referral. (See footnote for creation explanation)

major disabling condition at referral into three general areas, physical impairments, mental retardation conditions, and all other psychoneurotic and personality disorders. The disabling condition information available on the R300 data set is very general and is limited in its usefulness. Splitting the variable into three areas allows for only a broad look at the impact of the disabling condition on earnings.

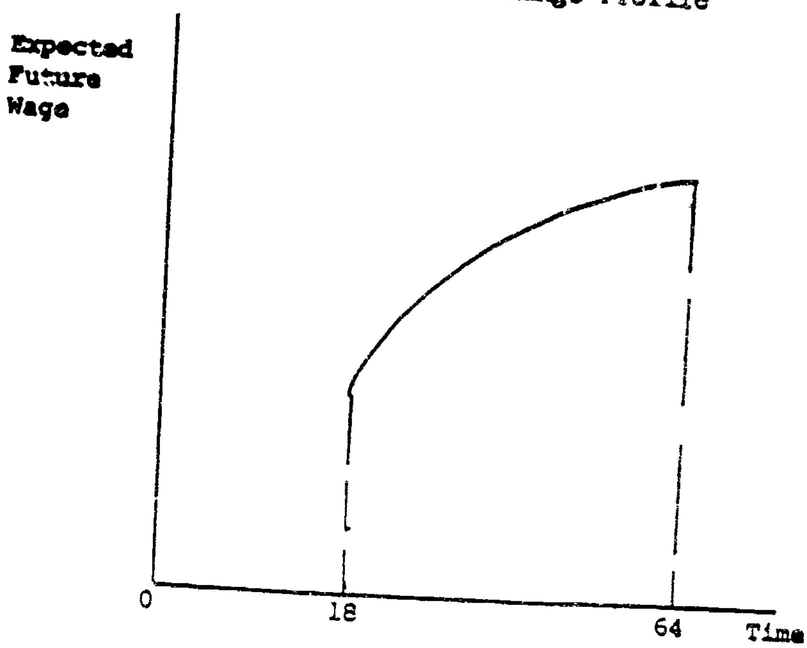
Other personal characteristics accounted for in the model include race, age and experience. Since no explicit earnings history is available for each client I have used age at program acceptance squared as an experience proxy. In "traditional" human capital theory the expected effect of lifetime experience on lifetime earnings is for earnings over time to rise, reach a peak and then begin to fall [22]. Since this is also the expected relationship between age and earnings, age at program referral squared serves well as an experience variable. I expect it to have a negative effect on lifetime earnings representing a quadratic function similiar to Graph 3.

The probability that a client will be in the paid labor force is a function of many of the same variables as the previously specified earnings equation.

The probability of client i being in the paid labor force at the time of program acceptance is expected to be positively related to age at program acceptance, years of schooling, and inversely related to health status, the presence of non-work

Graph 3

A Non-Linear Age - Earnings Profile



income, family income, and the number of dependents.

Identical health status variables are used in this equation as in the previous earnings equation. I have included the number of dependents squared to account for the expected non-linear relationship between family obligations and labor force participation. It is expected that the presence of dependents will have a diminished impact on labor force participation beyond some presently unknown number of dependents. Therefore, I expect to find a negative relationship between the number of dependents squared and labor force participation.

Lastly, I expect to find an inverse relationship between family income and labor force participation and an inverse relationship between the 0-1 variable representing the receipt of public assistance payments and labor force participation.[3]

Application

The one percent sample was divided by sex into two subsamples. Cleaning the data set of missing data in the primary variables resulted in data sets of 2062 males and 1565 females.[4] Further, I identified clients who reported positive earnings at acceptance and those who indicated they were working during the week of acceptance into the VR program.[5] The identification of these individuals was based on the assumption that every client working at acceptance will also report positive earnings at acceptance. This was generally found to be the case.

I first ran an earnings regression for all clients reported as working and reporting positive earnings weekly at referral, ($n = 221$ females, $n = 238$ males). I then used the coefficients generated from this regression with the characteristic matrix of all other clients to obtain an unadjusted prediction of potential weekly earnings.

Second, I used Heckman's [13] technique described in the previous section to compute an adjusted weekly earnings estimate for all other clients not reporting earnings. To obtain the probability that the value of time in the paid labor force is greater relative to the value of time out of the paid labor force, probit analysis was used. Via the probit analysis lambda, λ, was calculated for each client. The λ's purge the equation of selection bias to produce for unbiased estimates. Then an OLS earnings equation was estimated for all clients reported as working with positive weekly earnings at referral including λ as an explanatory variable. The coefficients from the adjusted earnings regression were used to compute unbiased predicted weekly earnings for all other clients in their respective subsamples.

Lastly, I compared the results of the unadjusted and adjusted OLS regressions.

Empirical Results

The two-stage selection-bias correction technique predicts earnings for nonworking male and female VR clients that are

roughly double the nonzero, nonmissing mean for male and female clients reported as working and having positive earnings at referral, [See Table 6]. These predictions represent earnings that are purged of any unmeasurable characteristics found to be unique to clients working and reporting positive earnings at referral. Predicted earnings uncorrected for sample selection-bias are closer to the nonzero, nonmissing mean in both samples. However, these predictions are fundamentally incorrect due to the lack of a correction for the sample selection-bias.

For the OLS adjusted model lambda, λ , is large, negative and easily significant at a one percent level for both sexes. This finding offers important evidence supporting the assumption that there are indeed unmeasurable characteristics that distinguish clients working with positive earnings from all other clients. The negative coefficient of λ represents the existence of negative correlation between the error term of the participation equation and the earnings equation. Adding more overall support for the inclusion of an exogeneous variable to purge OLS coefficients of their selection-bias is the change in the R^2 value. Inclusion of the lambda term in the earnings equation more than doubled the explanatory power of the independent variables on the dependent variable, for both sexes, [See Tables 8 and 9].

In the participation equation I find interesting results,

[See Table 7]. The most interesting is the effect of dependents on participation with respect to sex. Males and females were found to have opposite signs for the coefficients of the number of dependents and dependents squared variables. Although none of the coefficients are statistically significant they suggest an important observation. The presence of dependents beyond some presently unsolved for level have a positive impact on the labor force participation of men and a negative impact on women.

It is observed that the presence of public assistance payments received by male and female clients is a significant deterrent to labor force participation.[6] However, family income is observed to be positively related to labor force participation for both sexes.

The presence of a severe primary disabling condition is also found to be a strong deterrent to labor force participation for both sexes, while the presence of a secondary disabling condition has no statistically significant effect on either sex.

Lastly, I find no significant relationship between the type of major disability and labor force participation for either sex.

In the earnings equation there are no clear parallels between males and females. Years of schooling has a positive and significant impact on men's earnings before and after correction for sample selection-bias, but not so for females. Likewise for age at referral. Men appear to strongly adhere to "traditional" human capital theory assumptions before and after correction but

less so for women.

A curious result is found in regard to the change in importance of the presence of a severe primary disabling condition. After correcting for sample selection-bias the presence of a severe primary disabling condition is positive and significant in its effect upon earnings. The presence of a secondary disabling condition has no significant impact on earnings, amd its coefficient is negative for both sexes. No significant findings can be reported with regard to the type of major disability. It is difficult to criticize the modal for this failing given the considerable latitude the client has when reporting this information.

The finding that nonworking VR clients are predicted to have earnings at referral approximately double the earnings of clients reported as working at referral is perhaps against one's intuition, but is theoretically and statistically possible. Nonworking clients at referral could be observed as not participating in the labor force simply because their value of time in the home (the reservation wage) is greater than their value of time in the labor force, (the market offer wage). A client's value of time spent participating in the labor force is observed to be the market offer (accepted) wage. The value of time for clients out of the labor force is a function of disability and all other transfer payments. Burkhauser and

Haveman [6, p. 54] provide a good explanation for why reduced work effort can be expected given a generous income replacement program.

Consider a client whose guaranteed level of disability insurance (e.g. SSDI) is $400 per month, and whose impairment has sufficiently improved to warrant $750 per month if working full time. Further assume this client is subject to an earnings ceiling of $350. This client can earn up to $350 per month and still receive all of the allotted $400 per month transfer payment. Beyond $350 in earnings per month, this client is no longer eligible for the disability related transfer payment. Assuming leisure is a "normal" good, a utility maximizing client would choose to work part time earning $350 and remain eligible for $400 in disability transfer payments, rather than work full time for an identical amount of total income, $750. Burkhauser and Haveman also report the disincentive effects of transfer payments on labor force participation increases with decreases in health status, [6, p. 53]. Therefore, the notion the VR nonworking clients are typically the most severely disabled with the fewest skills to offer in the labor market does not invalidate the findings of this thesis. Table 6 reports weekly earnings for clients reported as not working at the time of referral that are to be interpreted as the value of their time in the home. Again, the value of time spent in the home (out of the labor force) is increased by their disability transfer payment

income. The value of time spent out of the home (in the labor force) must be greater than the disability transfer income to fully draw these clients into the labor force. Therefore, it can be stated nonworking clients have higher reservation earnings than clients already in the labor force whose reservation earnings have already been exceeded by the market offer (accepted) wage. Consequently, from higher reservation wages follows higher predicted earnings for nonworking clients.

Statistically, the finding that predicted earnings for nonworking clients are greater than working clients is possible due to the difference in the denominator for lambda for workers and nonworkers $\hat{\lambda}_j$ and $\hat{\lambda}'_j$ respectively.

It is reported in Table 6 that the estimated lambda in the adjusted model for working male and female clients is greater than the estimated lambda for all other (nonworking) clients. Using equations (17, 18) and Graph 2 it can be demonstrated why the denominator of $\hat{\lambda}'_j$ is generally taken to be smaller than the denominator of $\hat{\lambda}_j$. To the left and right of zero, the standardized mean, the observed values are negative and positive respectively. A positive and relatively larger denominator of λ_j should yield a small yet positive number, while the negative and relatively smaller denominator of $\hat{\lambda}'_j$ should yield a large and negative number. As a result of averaging over the samples of men and women, the average $\hat{\lambda}'_j$ is very very small yet positive

Table 6

Predicted Weekly Earnings at Referral, By Sex, for the Selection Bias Unadjusted and Adjusted Models

	MALE	FEMALE
Nonzero, Nonmissing Mean	$154.06 (n=238)	$112.79 (n=221)
Mean Predicted Weekly Earnings for Clients Working and Reporting Earnings at Referral		
Unadjusted Model	$154.06 (n=238)	$112.79 (n=221)
Adjusted Model Mean Lambda (Estimated)	$154.06 1.4242 (n=238)	$112.79 1.3766 (n=221)
Mean Predicted Weekly Earnings for All Other Clients Using the:		
Unadjusted Model	$293.67 (n=1824)	$107.12 (n=1344)
Adjusted Model Mean Lambda (Estimated)	$327.79 .18583 (n=1824)	$245.86 .22637 (n=1344)

Table 7

Probit for Participation Choice, By Sex

Variable	MALES N = 2062 Maximum Likelihood Estimate	Standard Error (Asymptotic T Statistic)	FEMALES N = 1565 Maximum Likelihood Estimate	Standard Error (Asymptotic T Statistic)
Years Of Schooling	0.337507	0.01593 ** (2.119)	0.041076	0.01790 ** (2.295)
Age At Referral	0.007485	0.00329 ** (2.273)	0.006563	0.00313 ** (2.094)
Number of Dependents	-0.090166	0.06307 (-1.430)	0.163726	0.08979 * (1.823)
Number of Dependents^2	0.019418	0.01153 * (1.684)	-0.038116	0.02331 (-1.635)
Public Assistance Payments Received at Referral 1 = Yes, 0 = No	-0.587286	0.15370 *** (-3.820)	-0.692705	0.14360 *** (-4.823)
Family Income at Referral	0.002569	0.00022 *** (11.663)	0.001838	0.00022 *** (8.188)
Major Disability: Physical Impairments 100-149, 600-699	-0.099065	0.10180 (-0.974)	0.048430	0.11670 (0.415)
Mental Illness 500-510	0.006445	0.12550 (0.051)	-0.174967	0.12830 (-1.364)
Mental Retardation 520-534 (Reference Variable)	. .	. .	. .	. .
Presence of a Severe Primary Work Limitation 1 = Yes, 0 = No	-0.371219	0.08501 *** (-4.367)	-0.450345	0.09100 *** (-4.949)
Presence of a Secondary Work Limitation 1 = Yes, 0 = No	-0.016703	0.09205 (-1.81)	0.017653	0.09588 (0.184)
Constant	-2.491290	0.23930 *** (-10.413)	-2.237990	0.28120 *** (-7.958)
-2 x likelihood ratio	-2(-617.43)***		-2(-550.72)***	

Dependent Variable is Working at Referral with Positive Earnings at Referral

* = Significant at a 10% level
** = Significant at a 5% level
*** = Significant at a 1% level

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Table 8

Earnings Equation for Male Clients Reported as Working with Weekly Earnings at Referral
(N = 238)

Variable	UNADJUSTED MODEL Coefficient	UNADJUSTED MODEL Standard Error (T Statistic)	ADJUSTED MODEL Coefficient	ADJUSTED MODEL Standard Error (T Statistic)
Years Of Schooling	13.1157	2.776 *** (4.726)	7.1135	2.521 *** (2.822)
Age At Referral	8.4729	2.872 *** (2.95)	5.6014	2.485 *** (2.254)
Age At Referral ^{2}	-0.09473	0.03592 *** (-2.638)	-0.0651	0.03082 ** (-2.113)
Race: 1 = White, 0 = Otherwise	14.1578	18.5 (0.765)	11.3774	15.99 0.712
Major Disability: Physical Impairments 100-149, 600-699	23.3853	17.41 (1.344)	21.2797	15.35 (1.386)
Mental Illness 500-510	-34.7919	21.73 (-1.601)	-27.7270	18.8 (-1.475)
Mental Retardation 520-534 (Reference Variable)	. .	. .	. .	.
Presence of a Severe Primary Work Limitation 1 = Yes, 0 = No	-11.4408	14.2 (-0.806)	31.9206	13.28 ** (2.404)
Presence of a Secondary Work Limitation 1 = Yes, 0 = No	-24.1169	15.34 (-1.572)	-21.5003	13.32 (-1.614)
Constant	-173.114	59.55 *** (-2.907)	141.8910	63.49 ** (2.235)
Lambda	. .	. .	-142.9290 1.4242 a	16.4 (-8.716)
R^2	0.17336		0.349	

Dependent Variable is Weekly Earnings at Referral

* = Significant at a 10% level
** = Significant at a 5% level
*** = Significant at a 1% level

a = The Mean Lambda for Male Clients Reported as Working with Positive Weekly Earnings at Referral

Table 9

Earnings Equation for Female Clients Reported as Working with Weekly Earnings at Referral
(N = 221)

Variable	UNADJUSTED MODEL Coefficient	Standard Error (T Statistic)	ADJUSTED MODEL Coefficient	Standard Error (T Statistic)
Years Of Schooling	5.0263	1.827 *** (2.731)	0.933	1.638 (0.570)
Age At Referral	4.6343	1.865 ** (2.485)	1.5670	1.573 (0.996)
Age At Referral ^{2}	-0.0492	0.02301 ** (-2.138)	-0.0196	0.0193 (-1.010)
Race: 1 = White, 0 = Otherwise	22.8763	11.44 ** (1.999)	13.1401	9.886 (1.329)
Major Disability, Physical Impairments 100-149, 600-699	-2.8639	12.64 (-0.227)	-11.1813	10.46 (-1.069)
Mental Illness 500-510	-5.4243	14.48 (-0.375)	12.1812	11.86 (1.027)
Mental Retardation 520-534 (Reference Variable)	. .	. .	. .	. .
Presence of a Severe Primary Work Limitation 1 = Yes, 0 = No	6.0672	9.456 (0.642)	39.0788	8.651 *** (4.517)
Presence of a Secondary Work Limitation 1 = Yes, 0 = No	-14.7463	9.953 (-1.482)	8.5516	8.609 (-0.993)
Constant	-53.9463	41.57 (-1.298)	210.7150	46.42 *** (4.540)
Lambda	. .	. .	-109.569 1.3766 a	12.38 *** (-8.848)
R^2	0.0950		0.2998	

Dependent Variable is Weekly Earnings at Referral

* = Significant at a 10% level
** = Significant at a 5% level
*** = Significant at a 1% level

a = The Mean Lambda for Female Clients Reported as Working With Positive Weekly Earnings at Referral

while $\hat{\lambda}_j$ is also positive but larger.

The adjusted earnings equation for the male and female samples [See Tables 8, 9] estimate lambda coefficients that are large, negative and statistically significant at a one percent level. These negative coefficients when multiplied by their respective lambda values will lower the predicted weekly wage more for VR clients working at referral than for clients not working.[7] Hence, the observed average predicted weekly earnings for nonworkers is greater than the average predicted weekly earnings for workers.

Conclusions

The usual foundation on which to begin estimating benefits attributable to the VR program is to use client earnings prior to and after program participation. Two problems are encountered when one attempts to measure the change in earnings capacity attributable to the VR program for clients with zero earnings at referral and positive earnings at program closure. The first is sample selection bias. The second is a data set problem.

This chapter addressed the need for, as well as, describing a technique for correcting sample selection bias. It may be unrealistic to believe a client who reports zero earnings at the time of referral has no earnings capacity. In the absence of zero earnings capacity prior to the beginning of the program a value for this earnings capacity might be imputed to these clients so as to not drastically overstate the value that VR

participation has upon earnings. Obviously the differences in earnings attributable to VR will be enormous when comparing methods imputing earnings to clients reporting zero against methods leaving zero reported earnings unchanged.

One method to predict earnings for clients reporting zero earnings at referral is to use the method of ordinary least squares. However, in general it is unacceptable simply to run a regression on a sample of clients working at referral and then apply the resulting coefficients to clients not working at referral in order to impute an earnings figure for them. This chapter presents an improved method of imputing earnings to clients reporting zero earnings at referral to the VR program. Both of these methods for imputing earnings values at referral are a function of earnings information from workers who enter the program and report positive earnings at referral. They are also dependent upon many other characteristics of workers such as education, the number of dependents, age, race and sex.

The model will have shortcomings depending upon the perspective one takes in measuring the benefits attributable to VR participation. Benefits accruing to the client are not necessarily the same as benefits received by society or the VR agency itself. The predicted weekly earnings at referral estimated in this chapter for clients reporting zero earnings at referral represents each client's reservation earnings. These

reservation earnings also represent each client's opportunity cost of forfeiting disability transfer payments for paid labor market activities. Therefore, from the client's perspective if $400 in guaranteed disability benefits at referral are forfeited for full-time employment of $750 at closure, the individual's benefit attributable to VR participation would be $750 - 400 = $350. However, if the individual worked part-time earning $350 in addition to the guaranteed benefit of $400 for a total earnings of $750 it is unclear if any benefit to the individual can be attributed to VR. On the other hand, if at closure this individual earned $750 by working full-time and not receiving disability payments the benefit to society would be $400. Moreover, the individual is no longer dependent upon government funding.

The technique proposed in this chapter to predict weekly earnings to clients reporting zero earnings at referral is best suited to measure the benefit received by individuals as a result of VR participation. It is not possible to infer benefits attributable to the VR agency nor to society through this technique. The two-step technique can not produce predicted earnings for each client solely as a function of their labor market skills (human capital) and personal characteristics. The technique instead predicts reservation earnings in the context of what a client would have to earn to draw them into the labor market, not what they could earn for a weeks work in return for

their labor. The VR agency ideally strives to improve the human capital of its clients. Measuring improvements in human capital due to VR participation requires a different model, which would control for the reduced work effort disability transfer payments induce.

The second problem that must be addressed when working with R-300 data is a missing information problem. The R-300 data are reported by counselors based on case records and client-counselor interviews. Checking and editing of the data appears to be casual. Two percent of the clients in the one percent sample do not have a reported sex, six percent do not have a reported race. While this is not a large missing information problem, it does represent deficiencies in the editing process. The magnitude of the nonreported data grows as the nature of the information to be collected becomes less straightforward. Better data on client earnings, characteristics and disabling condition could add significantly to the robustness of my findings.

ENDNOTES

1

I understnad this to mean clients who have reported no earnings have this value imputed to them, but clients who report zero earnings remain as zero values.

2

The severity of the primary work disabling condition is identified by a counselor check item. See the RSA Manual [23, p. 56-64].

3

The Family Income variable is collected in discrete, even money intervals by the RSA. I have converted each client's family income response into a continuous variable by converting each response into the midpoint of the indicated interval.

4

Variables "cleaned" of missing data are: Weekly Earnings at Referral, Age at Referral, Work Status at Referral, Years of Schooling, Number of Dependents, Family Income, Major Disabling Condition, Sex, and Race.

5

According to the RSA Manual [23, p.44] a person who did any work at all during the preceeding week is to be classified as working in one of the first six categories.

6

The possibility exists that this variable could be negatively correlated with labor force participation. The RSA manual [23] indicates this variable refers to money payments made to the client under the federal program of Supplemental Security Income (SSI), AFDC, and General Assistance (GA).

7

This occurs because the lambda value for working clients is on average greater than lambda values for nonworking clients.

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Chapter 9

IMPUTING BENEFITS TO PERSONS CLOSED NOT REHABILITATED

David Dean and Robert Dolan*

Introduction

One possible source of the bias in benefit cost calculations is the assignment of zero benefits to clients who are closed not-rehabilitated in Status 28, even though the total cost of services received by this cohort are fully weighed in the denominator. Of course, the reason for this approach is also clear. By definition, Status 28 case files do not contain earnings data. Even so, the presumption of zero benefits for Status 28 clients in the conventional benefit-cost model seems unjustified on both conceptual and factual grounds.

First, from a conceptual standpoint, economic evaluation should not lose sight of the broad intent of the program -- to reduce the extent to which functional limitations restrict work. The earning gains reported for rehabilitated clients are merely the best empirical proxies available to assess the extent to which a functional limitation has been mitigated. While earnings are a legitimate measure of program benefits for Status 26 closures, it may be inappropriate to presume the converse is true; i.e. that a lack of earnings as indicated by a 28 closure necessarily implies an absence of benefits. This emphasis on the

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existence or absence of earnings has thus led evaluators to take a binary view of program performance.

However, functional capability, though admittedly difficult to measure, is a continuous variable in that any changes that occur are incremental. So too is the nature of service receipts. Logically, it seems unduly conservative not to infer some level of benefits to clients who receive substantial amounts of services but, nonetheless, are deemed not rehabilitated due to a dichotomous view of success based on a rather arbitrary sixty-day vigil.

Furthermore, as a purely factual matter, there is evidence indicating that many clients closed in Status 28 do ultimately get jobs (See Chapter 14). Recent studies of the long-term impact of vocational rehabilitation services have found that several persons closed unsuccessfully in the traditional VR nomenclature did indeed have post-closure earnings. For example, of those persons treated and closed by VR in 1975, Social Security data link records for 1977 reveal that the "unsuccessful" Status 28 population had average earnings of $3,662. Moreover, these earnings were not dramatically lower than the $4,041 averaged among VR's successful Status 26 clients.

Finally, these actual earnings needn't be all that surprising when one recognizes the important respects in which the Status 28 cohort is similar to their "successful" Status 26 counterpart. The data in Table 9-1 illustrate this point.

Observe that in terms of clients characteristics, the Status 28 population reflects attributes which are strong predictors of earnings in traditional labor market analysis. For example, note that the two cohorts are virtually the same mean age, have

Table 9-1

Comparing Status 26 and 28 Populations

Description	Status 26 Mean (n=2969)	Status 28 Mean (n=1722)
Client Demographics:		
Age at referrral	30.72	30.62
Mean years of school completed	9.46	9.29
*Gender (% male)	57.0%	60.0%
*Race (% white)	70.0%	64.0%
*Marital status (% married)	26.0%	20.0%
Service Duration:		
*Time in restoration (months)	3.57	6.57
*Time in training and/or education (months)	12.59	10.14
Service Expenditure:		
Value of restorative services	$ 1080.59	$ 1198.33
*Value of educational services	$ 1968.82	$ 1339.71
*Value of training services	$ 254.88	$ 584.85
*Value of total services	$ 1654.18	$ 1178.34

* Denotes that the difference in means is significant at the .05 level.
Source: Virginia Department of Rehabilitative Services, FY 1982, Richmond, Virginia.

comparable educational backgrounds, and are of nearly the same average marital status and racial composition. Table 9-1 also reveals that the Status 28 cohort receives a substantial level of VR services. Compare, for example, the duration and value of specific services received across cohorts. In total, the average Status 28 client in Virginia received $1178 of services. Note that this level of service receipts is not substantially below that of the average Status 26 client.

In sum, there is adequate reason to believe that many Status 28 clients derive significant benefit from their VR experience, even though researchers lack the convenient sixty-day earnings datum to measure it. While it is true that the earnings gains are probably not as great as for successful clients, and that many clients closed Status 28 are in fact "too severely disabled" to be placed, it is also true that many clients are deemed not rehabilitated for reasons such as movement out of state, which are quite unrelated to either function capabilities or the VR program. Hence we contend that it is inappropriate for the benefit-cost analysis to assign zero benefits to these clients while fully accounting for their service costs.

Imputing Status 28 Earnings

There is a growing body of literature within labor economics dealing with the type of missing data issue encountered here [Gronau (1973); Lewis (1974); Heckman (1976, 1979); Heckman, Killingsworth and MaCurdy (1981); Bloom and Killingsworth (1982);

and Killingsworth (1983)]. In a generic sense, our attempt to estimate earnings for the Status 28 population falls within a censored sample framework. The Status 28 client represents a "censored" observation because the case service file, though complete in every other respect, lacks the earnings datum necessary to measure benefits.

One way to adjust for a censored sample is to fit an earnings datum to each censored observation from the closure earnings reported in the Status 26 case files. These earnings may be assigned based on similarities in demographic characteristics, education, impairment and services receipts across clients in the two cohorts. Though this procedure is defensible in many research settings, such as political prognostication, it is not entirely appropriate for our purposes. Drawing such cross-inferences presumes the two populations are "identical on average", which is probably not true with respect to the two closure statuses. Though we have argued that the Status 28 cohort certainly receives something greater than the zero benefits traditionally assigned them, we are not suggesting that they are <u>equally</u> successful as their Status 26 counterpart. In short, such an assumption would press the thesis of this Chapter a bit too far.

Indeed, we would argue that there is very likely an important element of "unobservable" difference between successful

and unsuccessful clients. One might characterize this unobservable attribute in the Status 26 cohort as an attitudinal variable across clients -- call it "a preference for work", "stick-to-itiveness" or "a need to succeed". We are not suggesting that this type of demeanor, which clearly influences the likelihood of successful closure, is unobservable to the counselor. Rather, it is simply an attribute which, is not reflected in the R-300 data. In other words, there is a subtle yet systematic difference between Status 26 and 28 clients, and probably even a salient one in counselors' eyes, but nonetheless, this difference is not apparent from the data profile. Unless we can control for the part which "stick-to-itiveness" may have in explaining the earnings of a Status 26 client, the earnings imputed to Status 28 clients from the Status 26 case files would tend to overstate the future earnings capability of "unsuccessful", yet otherwise similar, VR clients.

As shown in Chapter 8, a statistical method of adjusting for this problem has been developed by Heckman (1976, 1979). This solution incorporates a "two-stage, selection bias-corrected regression technique". The core of the estimation is an earnings equation. The purpose of this equation is to identify how closely earning gains by VR clients are associated with a broad array of client and program characteristics. The earnings equation is written:

(1) $$EARN_c = f(MST, SEXM, RACEW, AGE_r, EDUC_r, EARN_r, RTIME, TTIME, \$REST, \$TRAIN, \$EDUC, DCOND)$$

$EARN_c$ is earnings at closure, the outcome variable of the program. The top row variables are in general non-programmatic characteristics that exist within the VR clientele. MST, SEXM, and RACEW are "either/or" binary variables distinguishing clients who are married, male, and/or white. AGE_r, $EDUC_r$, and $EARN_r$, denote clients' circumstances at program referral regarding age, last year of education completed, and earnings if any. The second row variables reflect programmatic dimensions: time in restoration (RTIME) and/or training (TTIME); dollars of services in restoration ($REST), training ($TRAIN), and/or education ($EDUC); and the nature of disabling conditions (DCOND). This specification of the earnings equation departs from convention in two respects. First, because earnings in most labor market analyses vary widely, it is common to rescale the dependent variable as the natural log of earnings. This was not done here in order to retain the most intuitive interpretation of the regression coefficients possible. Second, it is mor common to control for the influence of sex and race by sub-sampling on these attributes rather than including them as independent regressors. This partitioning was done but the results were consistent with those reported here. In the interest of economy, we do not present results for the four individual race/sex sub-

samples. A summary of the variables appears in Table 9-2.

Equation 1 represents a multivariate regression model (OLS). The appeal of the OLS technique is that it approximates a randomized laboratory experiment which controls for the contribution to closure earnings that may be more correctly attributable to non-service variables, specifically pre-service client characteristics such as education, age, earnings history, etc. Estimation of this equation based on case service data yields an estimated coefficient for each of the variables listed on the right-hand side of the equation. The interpretation of the estimated coefficients is straightforward and intuitively appealing. Generally, a coefficient reflects the predicted

Summary of Variables Used in Earnings Regression

Dependent Variable = Weekly Earnings

Independent Variables	Description	Mean 26 & 28 Cohorts (n=3691)
AGE	Client age entering VR	30.7
EDUC	Average number of years schooling	9.4
MST	Marital status (% married)	23.6%
SEXM	Sex (% male)	58.1%
RACEW	Race (% white)	67.5%
EARNR	Weekly earnings prior to [illegible] ($)	$7.23
RTIME	Time in restoration (months)	1.3
TTIME	Time in education &/or training (months)	6.3
$TRAIN	Value of training services received ($)	$232.13
$EDUC	Value of education services received ($)	$340.39
$RESTOR	Value of restorative services received ($)	$407.02
SENSORY	Visual or hearing impairment	5.7%
PHYSIC	Amputee or orthopedic impairment	22.2%
MENTAL	Emotional disorders	20.0%
RETARD	Mental retardation	29.[illegible]%

change-in-earnings that may be associated with a "unit" change in the level of the right-hand variable, holding all other variables constant. Of course, the particular interpretation of a "unit" change in each case depends upon how the variable is measured -- either continuously, as in the case of years of education, or as a binary condition, reflecting whether a client is male/female, white/non-white, or married/non-married.

If one were comfortable with the assumption that the Status 26 and 28 cohorts are roughly identical on average, benefits could be imputed to Status 28 clients from the coefficients obtained by estimating Equation (1) with the complete Status 26 case data However, if, as we have argued, a systematic difference exists, a strict earnings extrapolation would impute benefits to the 28 cohort that are upwardly biased. Thus we employ the Heckman bias-correction technique.

The Heckman adjustment generates a new variable, Lambda ( ), which may be broadly interpreted as controlling for the possibly "unobservable" impact of "stick-to-itiveness" on both the likelihood of successful closure and the level of earnings. The inclusion of Lambda renders an augmented earnings specification differentiating the two cohorts. The significance of this variable indicates latent differences which may exist between 26 and 28 clients. In other words, the addition of the variable allows for a possible redistribution of the explanatory power across the variables in the earning equation and purges the

right-hand side regressors of any correlation with the error term. If the anticipated bias exists, this adjustment may reduce the magnitude, though not necessarily the significance, of the coefficients on the variables in the earnings equation. Hence, these bias-corrected estimates become valid parameters upon which to impute earnings to the Status 28 population.

The results for the OLS bias-corrected estimates appear in Table 9-3. Recall that the general interpretation of any coefficient is the amount that the dependent variable ($EARN_c$) correlates with a change in a given independent variable, holding other variables constant. For example, observe that a client is predicted to enjoy $5.75 higher earnings at closure for each additional year of education at referral, other attributes being the same. Similarly, the coefficient on SEXM indicates that male clients close with $31.36 greater earnings than an otherwise identical female.

For our purposes, it is convenient to discuss the results in the context of two composite clients, one each from the Status 26 and 28 cohort. These two clients are composite constructions in that they take on the mean value of each demographic, service, and disability variable for the respective cohorts. Though such a client is fictitious, this is an appropriate heuristic method by which to identify the likely source of earnings differences that exist between the Status 26 and 28 cohorts.

Table 9-3

Status 26 and Imputed Status 28 Earnings

	Bias-Corrected Coefficients	Status 26		Status 28	
		Mean	Earnings Impact	Mean	Earnings Impact
SOCIO/DEMOGRAPHICS					
AGE	-0.06	30.72	-$1.84	30.62	-$1.84
EDUC	5.75	9.46	$54.40	9.29	$53.42
MST	17.43	0.26	$4.53	0.20	$3.49
SEXM	31.36	0.57	$17.88	0.60	$18.82
RACE	10.81	0.7	$7.57	0.64	$6.92
EARNR	0.17	7.73	$1.31	6.37	$1.08
SERVICE DURATION					
RTIME	0.64	3.57	$2.28	6.57	$4.20
TTIME	0.69	12.59	$8.69	10.14	$7.00
SERVICE EXPENDITURE					
$REST	-0.0002	344.47	$-0.07	443.30	$-0.09
$EDUC	-0.0000	245.85	$0.00	395.22	$0.00
$TRAIN	-0.019	192.91	$-3.67	245.88	$-4.84
DISABLING CONDITION					
SENSORY	8.97	0.07	$0.63	0.03	$0.27
PHYSIC	-0.18	0.22	$-0.04	0.22	$-0.04
MENTILL	-20.25	0.16	$-3.24	0.26	$-5.27
RETARD	-13.45	0.29	$-3.90	0.31	$-4.17
SELECTION BIAS CONTROL					
LAMBDA	7.75	0.56	$4.34	-	-
INTERCEPT	59.88	1.00	$59.88	1.00	$59.88
ESTIMATED WEEKLY EARNINGS			$148.73		$138.81

The bottom row of Table 9-3 indicates that the estimated weekly earnings for our hypothetical Status 26 and 28 clients are $148.73 and $138.81 respectively. These figures are obtained by multiplying the bias-corrected OLS coefficients times the corresponding mean characteristic values and summing, along with the "Intercept", across characteristics. Recall that the bias-correction technique now permits the use of the OLS parameters since any unobservable differences between the two cohorts that may contribute to Status 26 closure is captured in the coefficient on Lambda. Note that Status 28 clients do not have earnings imputed to them based upon this coefficient since they do not possess the unobservable attribute we have referred to as "stick-to-itiveness".

It is important to note that, under our revised methodology, there appear to be two broad sources of difference between the Status 26 and 28 cohorts which contribute to differential earnings. First, in terms of observable factors, it is clear that the Status 26 cohort, though similar, is not identical to the Status 28 counterpart. We verify that Status 26 clients are on average slightly more educated, more married, more white, and enter the program with a slightly higher earnings record. Accordingly, the Status 26 cohort is predicted to close with modestly higher earnings. Collectively, these observable attributes account for $5.58 of the $9.92 weekly earnings difference previously cited. The remaining difference of $4.34

in Status 26 earnings is systematically rel--ted to "successful" closure as traditionally defined. Though unobservable, this is the effect gleaned from the construction and insertion of Lambda in the earnings equation. The coefficient on Lambda therefore reflects a fraction of earnings which shoul'd not be imputed to non Status 26 clients. In sum, however, our results suggest that the Status 28 clients achieve substantial earnings following their VR experience.

Conclusion

The main point to stress is perhaps obvious. Indeed, the statistical inference that the "average" Status 28 client may actually enjoy earnings of $138.81 is rather startling juxtaposed a methodology which has traditionally treated these clients as receiving no measurable benefits. The impact that our revised methodology imparts to the benefit-cost ratio is also clear since it suggests adding Status 28 benefits to a calculation which has typically considered only the service cost of this cohort. For example, in the Virginia VR program to which these data pertain,our model implies additional closure earnings of almost $11.9 million. Moreover, this figure represents a 54 percent increase in closure earnings as conventionally measured. In the context of these inferences, it is worth reflecting on one previously cited fact about Status 28 earnings. Recall the RSA-SSA data link study which found that the 1975 Status 28

population actual annual earnings in 1977 which were only $379 less than those of the Status 26 clients. It is interesting to note that the weekly earnings estimates cited in Table 9-3, annualized, suggest a roughly similar difference of $496.

It is also appropriate that these types of extrapolations be greeted cautiously. Indeed, these figures are presented largely to underscore our basic premise and should be appreciated more for their conceptual significance than quantitative precision. Our point is simply that program evaluation needs to consider the earnings prospects of Status 28 clients. As a minimum, this might involve a further refinement of the selection-bias correction technique applied here.

Chapter 10

BENEFIT COST ANALYSES CONDUCTED BY STATE AGENCIES

Frederick C. Collignon*

What benefit cost analyses are currently being considered by the state vocational rehabilitation agencies? What data are being used? What models are being followed? The purpose of this report was to provide answers to these and similar questions.

In this initial review of selected states' experiences, the following conclusions were reached.

(1) The R-300 was the principal base of data used by states for such analyses when undertaken.

(2) Most states at some time have now used benefit cost analyses to justify their programs to their state legislatures. They often will use RSA-issued studies directly (national data) to indicate the worth of their program, or will use what economists would term fairly crude calculations emphasizing change in earnings projected over a lifetime for clients in that state compared to average client costs. A number of states have done more sophisticated analysis.

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The basic model for these studies, whether explicity recognized by the states or not, has been Ronald W. Conley's model set forth in The Economics of Vocational Rehabilitation. The four generations of models developed by BPA derive from that model. Even when states cite sources other than BPA or Conley, when looked at closely, the models are quite similar.

(3) Though similar in structure, there is high variability across states in analytic findings. These differences are due, not only to state program performance, but to the types of benefits and costs included in the model. Those states which use more comprehensive lists of benefits do not have higher benefit cost returns because they tend also to use a more comprehensive lists of costs, and to be more rigorous in their measurement.

(4) Invariably, state report favorable benefit cost ratios. Only in the more sophisticated models does one occasionally encounter an unfavorable finding (i.e., negative results) for a particular disability group. This could be seen as simply a logical agency response -- if a finding is negative, don't present it. But in fact, we could identify no example of a state that had not found generally positive findings, even with extended adjustments to R-300 data.

There were major differences among states in their relative performances. State sutdies tend to compare results to national studies if they are favorable. They are silent on such comparisons if the state performance is less than the national

average.

(5) States generally consider only VR program costs in their analyses. They do not attempt generally (except for California) to measure similar benefits or the costs borne by clients, other agency programs within the state, or indirect federal costs (e.g., training, R&D, administration) in achieving rehabilitation.

(6) When subgroup analyses are done, states are willing to consider change in earnings and direct program costs as recorded on the R-300. The worries among researchers concerning the lack of data for a sub-population (e.g., disability-specific mortality rates or follow-up data) are ignored by state programs. Since such data don't exist, and perhaps could only be gathered at great costs, the state agency practices are not unreasonable.

(7) We are unable to find any model more comprehensive in structure or data-based in its costruction than the California State benefit cost study, which represented the fourth and last generation of the Berkeley model. It still remains "state of the art" among state studies.

There has been changes in state practices in use of benefit cost studies since the late 1970's. We undertook to review some states whose models have been praised by regional offices and others. The information we found is summarized in the attached chart. Some information was received from the following states:

Alaska, Arizona, Delaware, Michigan, California, Nevada, Oregon, Virginia and Washington. Six of these states are included in the chart. The others were no longer doing benefit cost analyses other than simply earnings change compared to cost, or in the case of Virginia, working on a new model.

The model most cited among states in recent years has been Ross Moran's model developed in Oregon as part of an RSA program where six states were made "model states" for evaluation. Its foundations were in the BPA models. Some regional offices have been citing the Arizona state study as a model, but that study, in turn, acknowledges that it derives from the Oregon model. Both the Oregon and Arizona models are analyzed in the accompanying table.

Other discussions with state agencies by phone in this most recent review bore out a number of observations.

(8) When benefit cost analysis is used, its form is not one of societal return for the resources being invested, but rather taxpayer payback for the specific VR program expenditure of funds. Economists have long questioned such an approach but it appears to be the approach most state agencies currently find most responsive to the concerns of state legislatures. Such analyses permit separate calculations for the return to state as well as federal taxpayers. State calculations do not include, however, analysis of the state's contributions to the federal

Illustrative Review of Major State B/C Models

	Alaska	California	Michigan	Washington	Arizona	Oregon
Source of Model:						
BPA	"like BPA's"	X			X (Indirect)	X
RSA						
Other	State		State	State	State/Ore	State
Type of Analysis:						
Taxpayer payback		Used		X	X	X
B-C	X	Not used regularly	X		X	Break-even rate of return
Frequency of Use	Annual	Monthly report to DR	Haven't run in 2-3 years	Monthly	Annual - used once, but for last 3 years	Annual
Special Groups:						
Major disabilities		X				
Other	SD's	BEP SD/non-SD	Local level		Severe/non SD	i3-severe/non-severe agency referral source (ii) deaf, mental illness - but by source, not as disability group
Assumptions:						
Employment Retention	70% of 26's	Yes (63.5%)	Yes	For these 2 factors, respondent said "we come in with a variety of options for the administration to consider	80% in text 76.5% in bowels of model	92%
Source (F-U = follow-up)	F-U survey (1 year)	State survey	2-year F-U survey		Other studies; Arizona RSA annual reviews	State unemployment rate (8%)
Earnings Increase	Don't know	Yes			General population in state rate Δ income (7.4%)	No
Source		State survey (14.8% 1st year)			(Not given)	Assume wage Δs offset retention Δs
Homemaker Valuation	No	Yes	Yes, early on Not incl. later years	No	No (Arizona discourages all homemaker closures	No
Source		Replacement costs by taxes ($7772/yr)	"RSA study"			
Return Clients	No	Yes	Yes	No	No	No
Basis		R-300	10% (R-300)			

	Alaska	California	Michigan	Washington	Arizona	Oregon
Control Group Adjustment Basis	Pre-post earnings comparison	20% reduction on top of earnings change State review of cases - clinical judgment	Earnings change (like Alaska)	Earnings change (like Alaska)	Earnings change (like Alaska)	Yes 20% reduction source: BPA
R-300 basis	R-300 (service)	R-300		R-300, RSA2, and RSA113	R-300	R-300
Other data source	budget to state	Accounting Dept.	F-U survey		External non-state studies state tax tables	State surveys
Costs included:						
Services	X	X	X	X	No } total state VR budget	X
Similar benefits	No	X 25% of case service costs	No	No		No
Salaries and admin.	X	X	OH & cash salary case service $	X		X
Adjustment to Earnings Prior to Referral	No	Yes		No	Yes	Yes
Amount			Average earnings year prior, from intake interview		+ 39%	+ 39%
Source		RSA Audits/BPA			Moran/Oregon	state survey (+29%) with adjustments
Mortality Expectation Age	65 - avg. age = "worklife" 65	65	Didn't know	Yes	3.5%/year	3.5%/year
Source		non-SDs - Society of Actuaries SDs - Railroad Retirement Board		Didn't know	Retirement age of 62 Moran/Ore.	Age 62 Bureau of Census, 1976 (adjusted for sex/age)
Adjustment for Young Clients Basis	No, see above	Yes 1975 U.S. Census age/earnings profiles	No	No	No	No
PA Reductions: Types included	SSI/DI, CA, AFDC (from R-300)	SSI/DI, CA, AFDC (R-300) Medicare	Same as Alaska, from R-300	R-300 source	"Total state PA" Social security	SSI/SSDI minimum benefit med (not R300 A) PA on R-300
How far projected?	Worklife	Until payback occurs	One year	Over payback period	Worklife	Break-even % calculated
Basis	R-300	R-300	R-300	Constant	R-300	R-300

costs. Rather, they treat the federal contribution as implicitly matched by tax payments by state residents to the federal government. Sometimes (e.g., Arizona) they treat the federal payment as a windfall, and do the taxpayer analysis solely in terms of the return to the state treasury.

(9) Even those states which were among the first to do extensive benefit cost studies and follow-up surveys of clients on an ongoing basis have since cut back on such efforts. Michigan was the lead state in such analyses in the earlier 1970's. It initiated routinized annual extensive follow-up surveys in the late 1960's, long before any federal iniativa encouraging states to do such studies. But Michigan no longer conducts follow-ups. Its model is now quite simple. Similarly, California, which for a number of years gave the state legislature both a benefit cost model and a payback model, now gives only a payback analysis.

(10) Federal leadership in providing forms, models, and exhortations to do benefit cost studies has always been a principal factor in inducing states to undertake such studies. In recent years, the federal government has not been providing such strong directivas. States now carry out their own program so long as basic accountability is ensured. In that environment, many states have cut back on doing follow-up studies

(11) The current focus of states is more on cost-effectiveness analysis than benefit cost analysis. States

routinely analyze the costs of achieving 26 closure with different kinds of closures. Such data will be reported to legislatures and used internally for resource allocation. Dollar appraisals of the worth of such rehabilitation are given, when at all, to legislatures in the context of the overall state program, and often using national memorandum issued by RSA rather than individual state studies.

The "standards" suggested by RSA have been more influential than benefit-cost studies in shaping the kinds of analyses states do internally. The effort of recent years by state and RSA evaluation units has been in helping states understand how to improve their overall performance in terms of numbers of rehabilitants and reducing costs, not in terms of overall benefit cost analysis.

A good example in many states has been state agency reaction to supporting college education for disabled clients. Although such support is often justified by benefit cost analysis for disabled clients (albeit in the absence of control groups for clients having that capacity), most states now discourage such services. The costs per rehabilitant are high and the gain in earnings is ignored.

(12) Interestingly, there is the perception in those states which have done benefit cost studies that such studies are not influential in persuading legislatures to allocate more money.

This may be because in such states, all agencies are good at analytic data-based justifications of programs, and thus those programs which have survived with extensive funding over the years are now thosw which all are justified in terms of benefit-cost analysis. In such an arena of program competition, and given the inevitable uncertainty in projection of future benefits, success in getting resource allocations goes to those programs which can also demonstrate efficiency (e.g., costs per rehabilitant) and political clout.

(13) State agencies rarely use benefit cost analysis for internal resource allocation among clients. Rather, benefit cost analysis is principal by used to justify the overall program in competition with other programs for legislative resource allocation.

(14) States do use cost-effectiveness analysis for internal allocation, however. It is used somewhat for setting priorities among types of clients, but more often for setting priorities among sources of referrals and among types of closures (e.g., giving low priority to homemaker closures).

The politics within programs make it difficult for any state program to rule out services to a particular disability group. Most importantly, the mandate of the federal legislation -- which is strongly backed by public opinion and state politics in most states -- is to serve the most severely disabled. This mandate

may be directly adverse to the usual prescription of benefit cost analysis to serve those clients who can produce the most benefits for resources expended. To be sure, it might be that with proper control groups, it would emerge that the severely disabled yield the highest benefit cost returns. Obviously only rigorous benefit cost studies could answer such questions.

Reviewing this overall situation among states, I would offer the following conclusions:

(a) The California benefit-cost model still represents the most complete model yet used among the states.

(b) Federal leadership in providing easy models for state use and, most importantly, in providing better data on key assumptions (e.g., control group adjustments, other indirect benefits and costs) can be very influential. States will adopt that which is urged on them by RSA and made easy to use. The influence of the Berkeley and, more recently, the Oregon models was largely because they were also presented in such a way that they could be easily programmed by state agencies. With the advent of microcomputers and their use in most states, it should be much easier in the future for states to do benefit cost analysis, especially if the software were directly provided. Nonetheless, in a federal-state environment, where states are not required to issue benefit cost returns as part of federal reports, state agencies with performance problems or limited

resources will resist investing in such analyses. A comparative analysis across states issued by a federal agency would be highly controversial, but would be very effective in forcing state attention to benefit cost analysis. If Social Security data links were forged, such analysis would be feasible. A comparative taxpayer payback analysis would be difficult because it would require separate analyses using different states' tax schedules. But such data is obtainable.

(c) The current difficulty in comparing state studies is that they vary in the benefits and costs included in the model, and in the assumptions used. Some factors are more important than others. Those most important (but not in order of importance) are: discount rate, follow-up data ir assumprtions on post-closure jov retention, mortality rates, earnings increase, the value of similar benefits or other state/federal programs used in achieving rehabilitation beyond those directly expended by the state VR program, valuation of homemaker closures.

Chapter 11

COLLECTION OF DATA BY STATE AGENCIES

Stanley E. Portny*

Description of Agency Data

A. Overview

Fifteen State VR agencies were consulted to discuss their interest in current and previous efforts to perform benefit/cost analyses of their programs, as well as to discern the types of information which they routinely or periodically collect which might be of use in the conduct of such analyses. The Region in which each agency is located, together with its combined Federal and State obligations for Basic Support Services (Section 110), the total number of cases served (statuses 10 - 30) and the total number of successful rehabilitations (status 26) in FY 1982, are presented in Table 11-1.

As the figure illustrates, though the States were not selected by a strictly random or a structured sampling process, they tend to represent a cross-section of the State VR agencies throughout the country. All but two of the ten Federal Regions are represented. The 15 agencies include six General, six Blind and three combined. The agencies include some of the largest in the country in terms of both obligations and clients served

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TABLE 11-1

Agency	Region	Federal and State Sec. 110 Obligations FY 1982	Total Cases Served (Active Statuses) FY1982	Successful Rehabilitations FY1982
New Jersey General	II	$21,263,491	22,933	5,722
New Jersey Blind	II	5,191,791	1,653	348
Delaware Blind	III	562,061	105	24
Pennsylvania General	III	50,597,268	56,609	14,431
Pennsylvania Blind	III	7,588,035	3,326	569
Virginia General	III	25,908,052	20,563	5,087
Virginia Blind	III	3,212,006	1,566	404
Florida General	IV	34,646,919	31,565	7,931
South Carolina Blind	IV	2,533,084	871	221
Illinois Combined	[illegible]	38,959,743	29,735	7,051
Louisiana General	VI	29,950,517	30,190	6,0[illegible]
Texas General	VI	56,512,001	46,466	13,908
Iowa Blind	VII	2,518,046	542	90
Wyoming Combined	VIII	4,069,336	2,444	747
Nevada Combined	IX	4,755,514	2,599	1,030

Selected Characteristics of Agencies Surveyed

(Pennsylvania General and Texas General), as well as minimum allocation agencies (Wyoming Combined and Nevada Combined).

In addition to reviewing background documentation about each agency's information systems and program evaluation capabilities and activities, key staff were interviewed over the telephone regarding the agency's specific interests in and activities related to benefit/cost analysis. The following issues were discussed in this interview:

- The agency's general interest in benefit/cost analysis and particular ways in which such information has been used in the past, if any;

- Information routinely collected in the agency's client statistical system (other than that included in the RSA-300/911) which might be useful for describing the program benefits realized by clients;

- Information routinely maintained in the agency's financial information system which might be useful for describing the costs of services provided to clients;

- How, if at all, information regarding the use of similar benefits is maintained in the agency information system;

- The substance and procedures of any follow-up studies which the agency conducts of clients that have left the VR program;
- The nature of any functional assessment tools or indicators which agency service delivery staff use to describe client capabilities and/or progress; and
- The focus and analytical approach of any benefit/cost assessments which the agency had done of its own services.

Finally, 14 of the 15 agencies interviewed offered to send selected supporting materials which described particular activities or systems of theirs which might have a special relevance for benefit/cost analysis.

B. Individual Descriptions of Agency Capabilities and Activities

1. New Jersey Division of Vocational Rehabilitation Services (NJDVRS)

Overview

NJDVRS is in the final stage of developing a comprehensive, integrated, on-line management information system which will maintain and make available data on caseloads, individual clients and financial transactions. However, agency staff indicated that benefit/cost analysis is not a major interest of the agency at

this time. Rather, the MIS will be designed to facilitate monitoring of individual and agencywide case service delivery and financial transactions. Because of its comprehensive scope and integrated structure, however, the MIS will be capable of supporting a variety of benefit/cost analyses in the future, with special software development efforts.

Client Statistical Data

The statistical information maintained in the system for each client will be essentially the same as that which was included in the RSA-300.

Financial Data

The new MIS will maintain complete records of all financial transactions related to purchased case services. The date and amount of obligations, cancellations and expenditures will be kept, as will descriptive data regarding the type and amount of service provided and the identification of the provider. Information routinely available will include:

- Total expenditures to date for each client, caseload and the entire agency; and
- Cumulative expenditures to date for the life of the case (total and by individual service category).

Similar Benefits

The new MIS will have the capability to maintain records of

similar benefits received by clients. Information will be able to be kept about the type and source of the service, as well as the cost of the service and the client's outcome. Even though the agency has not chosen to make benefit/cost analysis a top priority at present, it appears that the comprehensive and integrated struc-ture of the system will effectively support this (and other types of) analysis.

Follow-up Studies

In response to VR Standard No. 6, NJDVRS had designed and administered follow-up questionnaires to a sample of clients who had been closed from the program for one year. The majority of information requested concerned the client's satisfaction with the program and the services received. However, several questions were included which attempted to elicit information about the client's work situation at the time of the survey, as well as his or her current earnings, the number of jobs held during the previous 12 months and his or her principal source of financial support (not, however, the dollar amount of that support). Unfortunately, the information obtained suggested that, of the 10% sample of status 26, 28 and 30 closures surveyed, only about 1/3 responded, thereby severely compromising the statistical validity of the information obtained.

A second follow-up activity was conducted in 1984, in conjunction with a CSAVR nationwide survey. While the

questionnaire used in this activity was almost identical to that described above, the instrument was administered to all clients closed, one month after they left the program. Once again, however, preliminary response rates were low (45, 30 and 25% for status 26, 28 and 30 closures, repectively).

In both instances, the reports prepared to describe the results of the surveys basically just included frequency counts of the particular reponses received for each question asked. No attempts were made to determine correlations between particular responses to different questions or to examine the patterns of responses in conjunction with selected characteristics of the clients.

Functional Assessment Indicators

NJDVRS does not use a functional assessment intrument to support the diagnosis of client capabilities and needs or the monitoring of client progress.

Agency Studies

The agency evaluation unit will, from time to time, produce studies which examine specific areas of program activities. Of particular interest is a study prepared in 1982 which proposed "A Program Cost/Benefit Model for New Jersey DVR." The study attempted to describe benefits to the client, to the Government and to society, in general, and to compare them to the costs of providing services to clients. The study was based on the following assumptions which, to different degrees, limited the

validity of the results:

- The difference in client income at referral and at closure can all be attributed to the services received from the VR program;

- Costs for VR services paid by clients and other sources are negligible; and

- An appropriate proxy for cost per successful rehabilitation is the total Basic Support Program expenditures for the year (combined Federal and State) divided by the number of rehabilated clients.

In addition, only data currently being collected by NJDVRS was considered for use in this analysis. While the report describing the results of this study suggests that the information would be of use to agency decision makers, no specific applications are discussed or illustrated.

In addition to previous work, the new integrated MIS will be able to make available a variety of data which describe various aspects of the costs of services and the benefits received by clients. While the raw data collected and maintained will be almost identical to that which had been collected previously, the new system will help to improve the accruacy of those data and it will make it easier to get an array of specialized reports describing the amount of purchased services which fall into

different categories. While certain report generators will be designed into the new system, there will also be the possibility of designing specialized analyses of the existing data, to support the conduct of ad-hoc studies, as they arise.

2. New Jersey Commission for the Blind and Visually Impaired (NJCBVI)

Overview

NJCBVI staff indicated that agency decision makers were mildly interested in benefit/cost analyses, but that they had not been a priority to date. During the past two years, the principal concern has been the design, development and implementation of improved on-line client statistical and financial information systems. The former has been operational for over one year, and it is anticipated that the latter will be operational by June 1985. The primary objectives for both systems are to insure accountability and compliance with Federal and State requirements, as well as to make available in a timely manner accurate data to support service delivery and financial transactions and overall agency management.

Client Statistical Data

Preliminary review of system descriptions suggests that the NJCBVI client statistical information system includes essentially the same data as the RSA-300.

Financial Data

According to the design specifications, the new NJCBVI financial information system will include current detailed records of all commitments, cancellations, invoices and payments. In addition, detailed records of the number of hours which NJCBVI staff (other than counselors) work with individual clients will be maintained. Besides straightforward listings of the service expenditures to date for each client, the following services cost information will also be available:

- Total expenditures for the life of a given case, by type of service and/or vendor, if so desired;
- Total expenditures for specified types of services in a given fiscal year; and
- Total expenditures for particular vendors in a given fiscal year.

However, while all financial transactions will include client identifiers and an indication of the client's status at the time of the transaction, preliminary discussions suggested that complete integration between the client statistical and financial information systems is not planned at present.

Similar Benefits

The new financial information system will have the capability to maintain records of similar benefits provided to

agency clients. However, the focus to date has been on getting the system to maintain accurate records of purchased services; and it is anticipated that the similar benefits recording capability may be used at a future date.

Follow-up Studies

NJCBVI is planning to do follow-up studies of all clients closed from the program one year after their date of closure. They have developed and piloted their questionnaire and methodology and will be forwarding copies with their supporting materials.

Functional Assessment Indicators

NJCBVI has, for some time, been looking for an appropriate functional assessment instrument which could help to facilitate rapid diagnoses and determinations of program eligibility. They have looked specifically at the Functional Assessment Inventory (University of Minnesota) and the Life Status Indicators (New York University), but have not been pleased with anything that they have seen to date.

Agency Studies

No studies have been conducted by the agency to date which have attempted to assess the relative benefits and costs of the NJCBVI program. Agency staff referred to the benefit/cost approach embodied in VR Standard 2 (see Appendix B); however, they did not indicate that these measures were extensively used

to support any aspect of agency operations or decision making.

It appears that NJCBVI will have a wide range of data with which to attempt to estimate program benefits and costs, once their two information systems are operational. However, the statistical and financial systems will not be integrated, so that it will be difficult to attempt to explore detailed relationships between service costs and selected client characteristics and outcomes. Further, the information systems themselves appear to have limited built-in capacity to support special studies and investigations of the statistical and/or financial data. Preliminary discussions suggest that such studies would have to be performed with the use of a special high level database inquiry language.

3. Delaware Division of the Visually Impaired (DDVI)

Overview

DDVI has only had a mild interest in benefit/cost analyses of agency operations. Being a small agency, the majority of their information related activities have been focused on collecting and reporting the caseload statistics which RSA has required and on monitoring the agency's financial status. While they feel that benefit/cost information would be useful to support agency planning and resource decisions, any BC methodology which they would consider using would have to be based upon existing data and require a minimum of staff time to

support.

Client Statisical Data

With minor exceptions, DDVI collects essentially the same client statistical data as was included the RSA-300. The DDVI client statistical information system is now maintained manually, and there are no plans in the forseeable future to convert to an automated support system.

Financial Data

DDVI maintains those financial records which are required by applicable Federal and State regulations to allow the agency to continue to qualify for program funding; basically these include records of all revenue received and expenditures made. At present, this information is maintained manually.

However, DDVI is currently in the process of developing an automated system, which will operate on a Personal Computer, that will keep track of authorizations, commitments and expenditures. They anticipate that this system should be operational by April 1985.

Similar Benefits

DDVI currently does not track the types or amounts of similar benefits used to support case service delivery.

Follow-up Studies

DDVI does not currently conduct follow-up studies of clients closed from the rehabilitation program.

Functional Assessment Indicators

DDVI service delivery staff do not now use a functional assessment instrument to facilitate client evaluation and/or monitoring. They have examined the Preliminary Diagnostic Questionnaire (PDQ) developed by the West Virginia Research and Training Center, but they felt it did not adequately address many of the special situations charactaristic of blind clients.

Agency Studies

To date, DDVI has conducted no benefit/cost studies of agency operations, nor do they have plans to do so.

4. Pennsylvania Office of Vocational Rehabilitation (POVR)

Overview

Benefit/cost analysis, per se, has not been a major focus of POVR, in large part because they have felt that they have not had sufficient data on program costs and benefits. Consequently, agency staff have undertaken several efforts during the past few years to improve the scope and quality of data collected. However, while the improved data which are becoming available have the promise of being able to support more comprehensive benefit/cost assessments, the principal objective of the POVR information system remains to support service delivery and financial transactions and overall agency monitoring of budget and program operations.

Client Statisical Data

The POVR client statistical system essentially contains the same data which were specified in the RSA-300.

Financial Data

POVR is in the process of introducing a new, on-line fiscal system which will maintain records of all authorizations, cancellations and expenditures; the target date for conversion to the new system is June 1, 1985. Provision will be made in this system to identify third party reimbursements for all purchased services which are paid for by POVR and one or more external funding sources. Included in this information will be any funds which the client contributes for his or her VR services. Once this system is operational, the following types of cost breakouts and summaries will be readily available:

- Cumulative cost per client, total and by service category:
- Cumulative costs by service category, for the entire agency;
- Costs of services by vendor, and so forth.

Similar Benefits

POVR has worked for several years to develop consistent and reliable procedures for reporting similar benefits used. The source, service type and amount and dollars saved are all recorded by the counselor and maintained in the centralized MIS; and a cumulative total of the cost savings to date for the life

of the case is automatically kept. Several years ago to help insure a common understanding regarding how to estimate and report similar benefits, special training was provided to all counselors throughout the State.

Follow-up Studies

POVR conducts an annual follow-up study of a 5% sample of all cases closed during the year from the VR program. In 1982 and 1983, the survey focused on: 1) severely handicapped competitive, 2) non-severely handicapped competitive, 3) severely handicapped homemakers, 4) severely handicapped not rehabilitated (28/30), and 5) non-severely handicapped not rehabilitated (28/30). In 1983, the survey consisted of an initial mailout, followed by a second questionnaire and a reminder letter to those who had not yet responded; the final response rate was a little less than 50%.

In addition to a variety of questions designed to assess the client's satisfaction with the VR program, the survey asks about the client's current employment situation, the number of hours per week worked, present earnings before taxes, principal source of support (but not the amount of that support), and the amount of money received the prior month from all sources of public welfare. Also, the client is asked to note his or her perception regarding whether his or her ability to perform specified self-care functions has "stayed the same, improved or gotten worse"

since leaving the VR program. Similar information is requested from clients closed as homemakers regarding certain skills and activities specifically related to homemaking.

Functional Assessment Indicators

POVR has tried both the West Virginia Research and Training Center's Preliminary Diagnostic Questionnaire (PDQ) and the University of Minnesota's Functional Assessment Inventory (FAI), though they are using neither one at present. While counselor reaction to the instruments was basically favorable, they felt that they required too much time to complete.

Agency Studies

POVR has not done any studies to date which have specifically entailed a benefit/cost analysis of the agency's VR program. While the information system which they are developing will contain a range of cost data which might be useful for such studies, it appears that special programming efforts will be required to extract the data in the appropriate format required to support such analyses.

5. Pennsylvania Bureau of Blindness and Visual Services (PBBVS)

Overview

Agency decision makers are interested in obtaining realistic estimates of program benefits and costs. However, benefit/cost analysis, per se, is not a current priority for PBBVS. While

both the client and financial information systems are automated, Central office and field staff frequently rely on backup records manually maintained in the field for required program and financial information. Consequently, a primary agency interest is to improve the existing information systems, so that they are capable of supporting effective and efficient service delivery and program monitoring and management.

Client Statistical Information

The PBBVS client statistical information system contains essentially the same information that was required on the RSA-300.

Financial Data

The State accounting system includes a complete record of all program expenditures made by the agency. However, since the purpose of this system is to monitor and account for individual financial transactions, no provisions exist to facilitate the analysis of this information on a client, service or vendor basis. Thus, though the data exist, it is questionnable whether, with the present system, they would be available to support assessments of program benefits and costs.

Similar Benefits

Plans for using similar benefits are noted in the Individualized Written Rehabilitation Program which counselors prepare for each client; however, the dollar value of similar

benefits actually used is not recorded, and no information about similar benefits is maintained in the agency's centralized information system.

Follow-up Studies

PBBVS does not conduct follow-up studies of clients closed from the program.

Functional Assessment Indicators

PBBS does not use functional assessments to aid in the evaluation or monitoring of clients.

Agency Studies

PBBVS prepared an analysis of program benefits and costs in 1982, which was based upon methodologies used by the West Virginia Research and Training Center and the Oregon VR Division. Benefit cost measures determined included the ratio of the discounted expected future earnings of the client to the one-time cost of rehabilitation and the ratio of the expected tax payback (including income taxes to be paid and reductions in Public Assistance and SSI/SSDI). The primary measure of client economic benefit was taken to be the difference in the client's weekly earnings at referral and upon closure. Further, the cost of a rehabilitation was defined to be the total PBBVS program budget divided by the number of successful rehabilitations for the year. It was noted that PBBVS had no way of accurately determining the total cost over the life of a case. In addition, since the data used for this analysis were obtained from the existing PBBVS

information system, the validity of the results may be questionnable (see comments under Overview).

6. Virginia Department of Rehabilitative Services (VDRS)

Overview

VDRS is continually exploring alternative approaches for assessing the effects of VR services and for monitoring expenditures and estimating the overall costs of services provided to clients. In addition, specific indicators with respect to which the program is assessed by the Virginia Secretary of Human Resources and the Governor include selected measures of financial benefits realized by clients served by the program. However, VDRS has not established benefit/cost analysis, per se, as a specific initiative to be pursued at present.

In addition to the conduct of special studies of program operations, the agency is in the process of developing a new client and financial information system. Preliminary review suggests, however, that the system will be primarily designed to facilitate efficient transaction processing and service delivery and financial monitoring; the extent to which the system will readily support non-routine analyses of the type required to explore program benefit/cost relationships is not clear.

Client Statistical Data

The statistical information maintained for each client is

essentially the same as that which was included in the RSA-300.

Financial Data

The current financial information system includes data on authorizations, cancellations and expenditures for purchased case services. In addition, the service type, an estimate of the number of units of the service or good provided and the provider are kept for each transaction.

While these data are currently maintained in the agency financial data base, it is not possible at present to readily develop special analyses of the data (such as, for example, the amount of expenditures by provider, the average expenditure for a certain type of service provided by a particular vendor, and so on) or to combine the financial data with caseload and client data (to yield, for example, the average expenditures for a given type of service for all clients with a specified disability). Such flexible analysis capability may be included in to the new information system being designed.

Similar Benefits

While VDRS encourages counselors to use similar benefits when preparing the client's service program and when attempting to procure those services, there currently is no attempt to collect and maintain centrally any information on the amount and types of similar benefits actually used. The similar benefits data which are maintained are kept in the counselor's field book, and the formats in which these data are maintained vary greatly.

Follow-up Studies

VDRS routinely conducts a follow-up survey of clients closed in status 26 and status 28 who have been out of the program for 12 months. The survey questionnaire, which is sent to between 20 and 25% of those closed in each category, includes questions regarding whether, where and how many hours per week the client is working; the client's average gross pay currently and at the time of closure; and the identity of the client's principal source of support. However, response rates tended to be between 25 and 35%, which substantially reduces the validity of any results obtained.

Functional Assessment Indicators

VDRS declared an interest, back in fiscal year 1982, to consider the feasibility and desirability of using one or more alternative functional indicators to describe the non-monetary benefits received by program clients. Among those instruments and scales considered were the Life Status Indicators, the proposed CSAVR Functional Gain Inventory and the Functional Assessment Inventory. However, top management decided to wait for the Federal lead, before acting to adopt one or a combination of these indicators.

Agency Studies

The most recent benefit/cost analysis which VDRS has prepared of its program was done in 1978; it followed the

methodology described by the West Virginia Research and Training Center.

Additionally, VDRS has included in its Executive Agreement (that is, the "contract" which each agency head has with the Governor regarding what the agency will be required to accomplish during the year) the following indicators, under the heading of "Cost/Benefits of VR":

- Average weekly earnings;
- Estimated increase in earned income of rehabilitants; and
- Estimated payments of taxes to governments.

While no special studies have been designed or are planned to obtain these data, they will have to be provided in progress reports on agency activity for the year.

7. Virginia Department for the Visually Handicapped (VDVH)

Overview

VDVH has not declared program benefit/cost analyses to be a specific agency priority. Their existing information systems are designed to meet the minimum requirements for program and financial accountability and compliance; and, even if data relating to program benefits and/or costs were being maintained, it would be very difficult to extract special tabulations or analyses of these data to support benefit/cost assessments.

Client Statistical Data

The statistical information which VDVH collects about the clients of its VR program and maintains in an automated data file is essentially the same as that which was included in the RSA-300.

Financial Data

VDVH currently maintains records of purchased case services in two financial systems. Case Cost Records are kept manually for each client served, which include a comprehensive listing of all expenditures for purchased services. Additionally, VDVH maintains automated records of all agency expenditures, as a part of the State's general accounting system. However, there exist no uniform procedures for maintaining ongoing records of counselor budgets, authorizations and cancellations.

Since the service codes used in the Case Cost Records and the automated financial system are not the same, it is not possible readily to develop breakouts of the total expenditures by type of service, by client or by vendor. While VDVH is considering the possiblitiy of developing an integrated statistical and financial information system at some time during the next two years, there are no plans to automate the Case Cost Records before that time.

Similar Benefits

VDVH encourages counselors to use similar benefits, and it

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is required that the source and amount of similar benefits which the counselor expects to use be recorded in the IWRP. However, this information is not reported or maintained centrally, and its recording in case files is not closely monitored, either.

Follow-up Studies

VDVH used to conduct annual follow-up studies of clients closed from the VR program when they were required by the VR Standards. However, these studies are no longer conducted, and no plans exist at present to resume them in the forseeable future.

Functional Assessment Indicators

VDVH does not use functional assessment indicators to support diagnosis or case monitoring.

Agency Studies

VDVH has conducted no benefit/cost analyses of agency operations.

8. Florida Office of Vocational Rehabilitation (FOVR)

Overview

FOVR has not identified benefit/cost analyses as a current agency priority. However, they are currently in the process of designing and developing an integrated, on-line statistical and financial information system which wil maintain, on an ongoing basis, a variety of data related to costs of service and benefits received. Further, the flexible nature of the planned system

suggests that analyses could be designed in the future which would use these data to investigate agency benefit/cost relationships.

<u>Client Statistical Data</u>

The basic client descriptors to be maintained in the new FOVR information system will be similar to those included in the RSA-300. However, several aspects of the planned system offer special opportunities to obtain improved measures of program benefits and/or costs.

- The client information section of the information system will be a part of the general CIS data base maintained by the Department of Health and Rehabilitative Services, of which FOVR is a part. Therefore, it will be possible to identify automatically other HRS agencies that are providing services to the FOVR client or to his or her family members.

- While the RSA-300 required that the total monthly amount of Public Assistance which the client was receiving at application and at closure be noted, the new FOVR system allows for the separate recording of three sources of PA and the monthly amounts associated with each. It does <u>not</u>, however, note for how long those payments were received.

- The number of hours which the client worked the week prior to application and at closure will be recorded.
- The client's principal source of support at application and at closure will be recorded, although neither the dollar amount of that support nor the percentage of the client's total support which that source represents will be indicated.
- The monthly amount which the client is receiving under Worker's Compensation at application and at closure will be recorded.
- The following Functional Gain Indicators originally included in the RSA-911 will be completed at acceptance and at closure for the client and entered into the system.
  - Education
  - Self care supervision
  - Self care assistance (hours, days)
  - Type of residence
  - Mobility
  - Expressive communication
  - Receptive communication
  - Adjustment.
- The name and address of the client's employer at closure will be maintained.

- Whether the counselor had 1) direct or 2) indirect involvement in the client's placement at closure will be noted and maintained.
- The following similar benefits data will be maintained in the system for each client:
  - Type of benefit
  - Date of benefit
  - Approximate value (specific guidelines have been given to counselors throughout the State about how to estimate the value of a similar benefit).

Financial Data

The Payments Management Component of the FOVR information system will include detailed records by client of all authorizations, cancellations and payments for purchased case services. With each transaction entry will be stored the name of the vendor, as well as the category and number of units of the service or good purchased. As the system will be fully integrated, any number of special reports containing the costs of specified services for clients with particular characteristics can be develop However, the system will have a built-in capability for generating the following information for clients identified by one or more special identification crieria (such as district, status, disability, referral agency, age and so forth.)

- Number of cases

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- Year-to-date costs
- Year-to-date average cost
- Life of case average cost.

Similar Benefits

FOVR is systematically estimating and recording similar benefits used by counselors, as described under Client Statistical Data.

Follow-up Studies

While they are not conducting follow-up studies currently, FOVR staff have done follow-up studies in the past (the last one was completed in fiscal year 1983) and plan to do them again in the future. The 1983 survey, which was conducted by handing out or mailing a copy of the questionnaire to the client at the time of closure, with instructions to complete and return it, dealt exclusively with issues related to the client's satisfaction with the services provided. No attempt was made to elicit any indicators of the client's economic or employment situation (and this was probably approriate, since the survey was administered right after closure). As the response rate was approximately 28%, however, it is not clear how reliable the results of the survey were.

Functional Assessment Indicators

FOVR is using the Functional Gains Indicators originally included in the RSA-911 in their new information system, as described under Clients Statistical Data.

Agency Studies

FOVR has not done any benefit/cost analyses of the program within the past five to six years.

9. South Carolina Commission for the Blind (SCCB)

Overview

SCCB has done little work directly related to evaluating the relative benefits and costs of program services; however, agency decision makers are very interested in obtaining better information regarding total case costs and the benefits realized from program participation. The agency has recently upgraded their computer hardware, and they are in the process of designing and procuring software to support expanded client and financial information systems.

Client Statistical Data

At present, SCCB collects and maintains essentially the same client statistics as were included in the RSA-300. Current plans for the revised Client Information System, however, call for the collection and maintenance of records of whether similar benefits were used to support services provided to the client in each of the RSA-300 specified categories. If similar benefits were used, whether they were from government, non-government or unknown sources would be noted. Further, in addition to recording the total cost of purchased services for a case, the dollar values of

similar benefits received from government, non-government and other sources, respectively, would be recorded.

Financial Data

SCCB currently maintains internal records of receipts, expenditures and balance of funds remaining on a Burroughs L9000 computer, which is essentially an automated posting machine. While the computer provides periodic summaries of all expenditures to date, it is not possible to use it to prepare reports in different formats, to develop expenditure summaries by type of service or to perform any types of analyses of the expenditure data maintained. While a new and much more flexible financial information system is planned, it is not clear at present exactly what information will be maintained in it, the capacity it will have to support ad-hoc analyses of existing data or the extent to which it will be integrated with the client information system.

Similar Benefits

SCCB does not now track the extent of similar benefits use. However, as described under Client Statistical Data, it is planned to include in their new information system descriptions of when similar benefits are used and estimates of the dollar amount of similar benefits used for each case.

Follow-up Studies

SCCB does not regularly conduct follow-up studies of clients closed from the program. While such studies have been conducted

in the past, they tended to focus on issues related to the client's satisfaction with the services received, and the response rates were extremely low.

Functional Assessment Indicators

SCCB does not use functional assessment tools to support client assessment or progress moonitoring.

Agency Studies

SCCB has not conducted any studies specifically designed to assess the benefit/cost ratio of program services. There has been general interest in gross measures of operating efficiency (such as, for example, the total program budget divided by the total number of successful rehabilitations), but there has been no attempt to develop accurate estimates of the total (including indirect and administrative) costs of providing services to an individual client.

10. Illinois Department of Rehabilitation Services (IDORS)

Overview

While selected efforts have been made in the past to perform a benefit/cost analysis of the agency's programs, there is no initiative to do so at present. Decision makers are emphasizing the need to use similar benefits and other approaches for reducing the cost to the agency of services provided, and the IDORS information systems are designed to support the monitoring

of these activities, as well as the monitoring and overall management of financial and administrative transactions involved in the delivery of case services.

Client Statistical Data

The data maintained in the IDORS client statistical system is essentially the same as that included in the RSA-300.

Financial Data

IDORS maintains detailed records of all authorizations, cancellations and expenditures for purchased case services. As these records contain the name of the vendor and the type and amount of good or service provided, it would be possible to obtain summary information on the amount of expenditures for different types of services. The financial information system is not, however, integrated with the client information system, so it would be difficult to obtain accurate tallies of the expenditures for particular types of services for clients with specified personal or closure characteristics.

Similar Benefits

IDORS has developed and promulgated throughout the agency very detailed instructions regarding the use and recording of similar benefits. Essentially, whenever similar benefits are used, the following information is recorded and maintained in the client information system:

- Source
- Service code

- Service description
- Client's status when service was received
- Amount IDORS would have authorized for the service, if similar benefits had not been received.

The agency routinely produces summaries, by service type and geographic location, of the amount of savings realized as a result of similar benefits usage.

Follow-up Studies

IDORS staff are currently designing a follow-up questionnaire which they plan to administer to clients closed from the VR program; they have not conducted such a survey for several years. The planned survey will ask whether the client is working, whether his or her job is the same one held at closure and other questions related to the client's employment situation. The survey would definitely be administered to status 26 closures; and consideration is being given to expanding the survey population to include status 28 closures as well.

Functional Assessment Indicators

IDORS does not use functional assessment tools to support the assessment or ongoing monitoring of clients in the VR program.

Agency Studies

The most recent IDORS attempt to assess a program benefit/cost ratio was done in 1981. This study used the same

methodology contained in RSA Information Memorandum RSA-IM-80-40, entitled "Distribution of Benefit/Cost Ratios: The State-Federal Program of Vocational Rehabilitation", dated July 15, 1980. As noted in the IDORS report describing the results of this investigation, the benefit/cost ratio derived only reflects total program costs and projected earnings of rehabilitated clients; it does not explicitly take into account savings due to reductions in Public Assistance or Social Security payments or to additional revenue that would be realized from increased income tax payments.

11. Louisiana Division of Vocational Rehabilitation (LDVR)

Overview

While LDVR administrators are very interested in more effective ways of estimating the costs and describing the benefits of participation in the VR program, the agency has not performed any benefit/cost analyses, per se, in recent years. At present, LDVR is in the process of completing a major redesign and updating of its client and financial information systems. It appears that the major objectives of these new systems will be to insure accountability facility transaction processing and provide a responsive data base to support management oversight of agency operations.

Client Statistical Data

LDVR client statistical information maintained in the centralized information system is essentially the same as that included in the RSA-300.

Financial Data

The new financial information system will maintain detailed records of all authorizations and expenditures for purchased case services. As the final system design is not yet completed, it is not clear whether the system will readily allow ad-hoc analyses of selected service costs or the integrated analysis of service costs for clients with certain specified characteristics.

Similar Benefits

While the agency encourages the use of similar benefits, comprehensive data regarding the type and amount of similar benefits actually used is not maintained in a central data base at present.

Follow-up Studies

In the past, LDVR has conducted follow-up studies of client closed from the program, as required by the VR Standards. The questionnaire recommended for use by RSA in conjunction with the Standards asked the respondent about present work situation, total income received by the respondent and by family dependents last month and total wages earned last week.

Functional Assessment Indicators

LDVR does not use functional assessment tools, at present,

to support client evaluation or monitoring. However, agency staff did indicate an interest in considering them in the future.

Agency Studies

LDVR has not conducted any studies specifically designed to develop benefit/cost ratios for agency VR programs.

12. Texas Rehabilitation Commission (TRC)

Overview

TRC administrators are definitely interested in the relative benefits and costs of their VR program. In addition to maintaining on-line client and financial information systems designed to support efficient service delivery, the agency has done several studies specifically designed to estimate benefit/cost ratios for the program.

Client Statistical Data

The TRC client statistical data base includes essentially the same elements as the RSA-300. A notable addition, however, is the recording at acceptance and closure of assessments of the following Functional Gain Indicators initially incorporated in the RSA-911:

- Education
- Self care supervision
- Self care assistance (hours, days)
- Type of residence

- Mobility
- Expressive communication
- Receptive communication
- Adjustment.

Financial Data

TRC maintains detailed records of all authorizations and expenditures for purchased client services. Included with each entry is a record of the vendor, the service type and the amount of the good or service procured.

Similar Benefits

TRC does not maintain centrally information on the amount of similar benefits used to support client services.

Follow-up Studies

TRC last conducted a follow-up survey of former clients in 1983. Questionnaires were sent to a 2% sample of status 26, 28 and 30 closures from 1981. In addition to questions about the client's satisfaction with the services received, the survey explored the respondent's current work status, pay and number of hours per week worked. Unfortunately, the response rate was only between 20-30%, so the validity of the results obtained is questionnable.

Functional Assessment Indicators

As noted under Client Statistical Data, TRC currently collects data on the Functional Gain Indicators originally

included in the RSA-911. However, after reviewing these data and concluding that they are of very limited value, TRC plans to stop collecting them after this fiscal year.

Agency Studies

In 1982 and again in 1983, TRC performed an analysis of program benefits and costs, in accordance with the methodology outlined by RSA in its 1982 Information Memorandum.

13. Iowa Commission for the Blind (ICB)

Overview

ICB administrators are interested in benefit/cost analyses of their VR program; they use such information to support budget requests, as well as to provide information on program performance to the public. However, being a small agency, ICB has limited resources which it can devote to the design and conduct of benefit/cost studies; and their existing manual information systems are only able to provide limited support for the requisite analyses which would be required. Consequently, ICB has adopted existing methodologies used in the VR field to develop rough estimates of program benefit/cost indicators.

Client Statistical Data

ICB maintains essentially those client statistical data which were included in the RSA-300. All client statistical data submitted to the central office are processed and filed manually.

Financial Data

ICB maintains manually a detailed record of authorizations, invoices and expenditures for client purchased services. However, even though the name of the vendor and the type of service are recorded, it would be extremely time consuming to develop special surmaries of cost data by type of service, not to mention by characteristic of client.

Similar Benefits

ICB does not routinely collect data on the value of similar benefits used to support case services.

Follow-up Studies

ICB used to conduct follow-up studies on clients closed from the VR program, when they were required by the VR Standards. However, they have not conducted such studies for the past several years, though they are contemplating conducting one in the future.

Functional Assessment Indicators

ICB staff have examined the Functional Assessment Inventory and the Life Status Indicators; however, they have not found an instrument to date which they felt would be appropriate for clients of an agency for the blind. Consequently, though they have an interest in such instruments, they do not use any at present.

Agency Studies

While they have not undertaken a full blown benefit/cost study of their VR program, ICB administrators have attempted to adopt appropriate portions of existing methodologies to develop rough estimates of program benefits and costs. In particular, they have used portions of the methodology presented by the West Virginia Research and Training Center to estimate program benefits in terms of public assistance payments saved and additional income and Social Security tax payments made by rehabilitated clients who earn salaries.

14. Wyoming Division of Vocational Rehabilitation (WDVR)

Overview

WDVR has undertaken several activities designed to develop improved assessments of program benefits and costs. In addition to adopting available methodologies to develop approximate benefit/cost ratios, agency staff have considered alternative approaches for measuring non-vocational gains, the retention of program benefits and the estimation of program costs. Further, WDVR staff are in the early stages of redesigning their client and financial information systems; they plan to have one integrated information system for all client related information within the next two years.

Client Statistical Data

The current WDVR client statistical information system

maintains essentially the same data elements that were included in the RSA-300.

Financial Data

WDVR maintains detailed records of authorizations and expenditures for all client purchased services. At present, however, there is no capability to do independent analyses of WDVR financial data or to link the client and financial data files.

Similar Benefits

Data regarding similar benefits used are now maintained in the client's case folder. It is planned to collect and maintain this information centrally when the new integrated information system is developed.

Follow-up Studies

WDVR now conducts follow-up studies of clients who have been out of the VR program for five years. More detail regarding the content, methodology and response rates for these studies will be provided when the supporting materials are received.

Functional Assessment Indicators

WDVR is interested in using a functional assessment instrument to support client assessment and monitoring. However, they have reviewed a variety of existing instruments and have not found one which they feel suits their needs, so they plan to attempt to develop one of their own in the future.

Agency Studies

WDVR staff have adapted existing methodologies to develop some approximations of benefit/cost ratios for the WDVR program. More detail regarding these studies and the reference methodologies will be included when the supporting materials are received.

15. Nevada Rehabilitation Division (NRD)

NRD staff expressed interest in program benefit/cost assessments, and have been pursuing a variety of activities designed to provide improved information regarding program benefits and costs to agency decision makers.

Client Statistical Data

NRD collects essentially the same client statistical data that were included in the RSA-300. Staff indicated, however, that it is difficult to perform special or ad-hoc analyses of these data, even though they are maintained on an automated system.

Financial Data

NRD maintains detailed records of authorizations and expenditures for all client purchased services. Additional comments will be included when the supporting materials are received.

Similar Benefits

NRD does not track the amount of similar benefits used in

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their central information system.

Follow-up Studies

Comments will be provided when supporting materials are received.

Functional Assessment Indicators

Comments will be provided when supporting materials are received.

Agency Studies

NRD has performed benefit/cost studies which were patterned after the California Department of Rehabilitation approach and the methodology described by the West Virginia Rehabilitation and Training Center. More details will be included after the supporting materials are received.

Benefit/Cost Data Maintained By
Selected State VR Agencies

A. Overview

The principal objective of this investigation was to explore the information which State VR agencies have available that could be used to support benefit/cost analyses of their programs. In speaking with staff from 15 selected State rehabilitation agencies, it was found that, while most indicated a general interest in the costs and the benefits of program services, none had declared the performance of a benefit/cost analysis to be a primary agency priority.

The majority of the agencies interviewed have or are in the process of developing automated systems for recording and maintaining client statistical and financial data. The principal objective of these systems is to provide accountability and compliance with Federal and State program guidelines, as well as to support efficient service delivery and agency program and financial management. As such, the core data maintained in these systems are similar. However, there are a number of unique and innovative approaches being taken by different agencies which were designed to provide information which would provide increased insight into some of the aspects of the true costs of service delivery and the benefits realized from program participation. Following are highlights of these systems and

practices which appear to be of potential use for benefit/costs analyses in the future.

B. Client Statistical Data

All 15 of the agencies studied routinely collect and maintain client statistical data similar to that which were required in the RSA-300; and 13 of the 15 agencies have or are in the process of developing automated information systems to maintain these data. However, almost none of these agencies collect any additional client data which would be of particular use for a benefit/cost analysis. Two agencies which do collect additional information which would facilitate a more detailed analysis of program benefits and costs are Texas General and Florida General. Both agencies are using the Functional Gain Indicators originally included in the RSA-911 to describe the client's situation at acceptance and at closure; and both are storing the results of these assessments for all clients in their centralized client information systems. However, Texas plans to discontinue this practice at the end of the current fiscal year, because agency staff have found the information to be of little use.

In addition to the Functional Gain Indicators, Florida is planning to include several information elements and procedures in its new information system which will provide additional information about the client's situation and program benefits

received. First, all VR clients will automatically be entered into the Department of Health and Rehabilitative Services Client Information System, so that it will be possible to determine whether the client or any family members is receiving services from other DHRS programs. Second, the sources and dollar amounts received will be separately maintained for up to three sources of Public Assistance. Third, in addition to earnings one week prior to application and upon closure, the number of hours worked per week in each case will be recorded. Fourth, the monthly amount received from Worker's Compensation at application and at closure will be maintained. Fifth, the client's principal source of support at application and at closure will be noted. And finally, note will be made regarding whether the client's counselor had direct or indirect involvement in the client's placement.

C. Financial Data

Each of the 15 agencies surveyed maintained detailed records of all expenditures for purchased case services; it appears that this information is required to satisfy program accountability requirements. Most of these agencies also noted in these records information about the type and amount of service provided and the identification of the vendor. In almost all cases, information was also maintained about authorizations for services.

However, though 13 of the 15 agencies had automated at least some portion of their financial systems, the extent to which

special groupings of this information, as well as integrated descriptions of the costs of services for clients with particular characteristcs, could be obtained varied greatly. Less than one third of the agencies had or are developing automated financial information systems which would be fully integrated with their client statistical data bases. Further, at least half of the agencies indicated that it would be difficult to run special analyses of the financial records to obtain totals of the amounts of funds expended by service category, vendor or other grouping. Several agencies noted that it would be difficult or impossible to determine accurate estimates of the cost of purchased services over the life of a particular case.

D. Similar Benefits

Virtually all of the agencies surveyed indicated that agency policy encouraged the use of similar benefits to support services included in the Individualized Written Rehabilitation Program, whenever possible. However, only five of the agencies had or were developing procedures for routinely collecting and maintaining centrally information about the magnitude of similar benefits used.

Pennsylvania General, Florida General and Illinois General each have counselors record and submit for each client the source, service type and amount and approximate value of similar benefits used. In their new financial information system which

is currently being developed, Pennsylvania will record the dollar value of third party reimbursement to the agency for all purchased services paid for by the agency and one or more external funding sources (including the client him or herself). In addition, each of these agencies has developed detailed guidelines and procedures and conducted extensive training of agency staff regarding the use and reporting of similar benefits. In their new financial information system, the New Jersey General agency will record the dollar value of similar benefits used. And, the New Jersey Blind agency will have the capability in their new financial information system to record this information, but there are no plans to require field staff to do so in the near future.

E. Follow-up Studies

Each of the agencies interviewed indicated that they had conducted follow-up studies of clients closed from the VR program in the past, when required to do so by the VR standards. However, only Pennsylvania General and Virginia General regularly conduct such studies at present. In addition to questions regarding the client's satisfaction with services received, both agencies solicit information about the client's employment situation and earnings at the time of the follow-up. Pennsylvania surveys 5% of selected groups of status 26, 28 and 30 closures and most recently has obtained about a 50% response rate. Virginia surveys 20 - 25% of status 26 and 28 closures and

obtains between a 25 and 35% response.

Of the remaining agencies, six indicated that they were planning to conduct follow-up surveys in the future and were in various phases of questionnaire design and pilot testing; and, each indicated that the survey would seek information regarding the client's current employment situation, the number of hours per week worked and the client's gross salary. The remainder expressed no plans for follow-up studies at the present time.

F. Functional Assessment Indicators

Only two of the 15 agencies surveyed are regularly using functional assessment indicators at the present time. Both Florida General and Texas General are having counselors complete the Functional Gain Indicators from the original RSA 911 for each client at acceptance and at closure; Texas, however, will be stopping this practice at the end of the current fiscal year.

Six of the 15 agencies have studied one or more existing instruments, but have not chosen to adopt them. (The instruments most frequently examined were the Preliminary Diagnostic Questionnaire from the West Virginia Research and Training Center, the Functional Assessment Inventory from the University of Minnesota, the Life Status Indicators from New York University and the Functional Gain Indicators from the original RSA 911.) Several of the agencies for the blind which examined one or more of these instruments felt that they did not adequately address

special situations of blind people.

G. Agency Studies

Six of the 15 agencies surveyed have conducted one or more benefit/cost studies during the past six years. For their study methodology, each agency used an approach which had been described in available literature in the VR field. Three of the agencies used the approach proposed by the West Virginia Research and Training Center two cited the RSA approach discussed in a 1980 Information Memorandum and one adapted the methodology employed by the Oregon Vocational Rehabilitation Division.

Each of the studies conducted relied on benefit and cost data currently existing in agency files. Consequently, cost of services was approximated by either the cost of purchased services or the total agency budget divided by the total number of successful rehabilitations for the year. And, increase in client earnings was approximated by the difference between the client's earnings at closure and the week before application.

Chapter 12

USING A `ETTER MEASURE FOR SERVICES

David H. Dean & Robert C. Dolan*

Current R-300 data reveal only the value of total services prescribed to a client along with a dichotomous receipt/non-receipt record of the service pattern. This recording of service costs is less comprehensive than is required for economic analysis in several respects. First, these data provide no information regarding the intensity or duration of specific services. These dimensions of the service pattern would aid program evaluation which currently views the rehabilitation process as a "black box". Program evaluation based on specific service data would further our understanding of the relationship between earnings outcomes and the nature of service patterns. This evaluative focus would yield information on the cost-effectiveness of specific services and lead to recommendations for allocating resources throughout the program.

There is some reason to question the accuracy of the total cost data now available. The costs reported on the R-300 are the value of services as estimated by a counselor from his or her case records. In contrast the enhanced data set for the Virginia

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VR program to be discussed in the first section was created from "vouchered" services (i.e., services actually paid out). This procedure revealed actual total service costs which were different from the Virginia R-300 figures.

A third problem with the service data is that they do not capture fully the range of services that a client can receive. Because VR is the service provider of last resort, one duty of counselors is to identify whether clients are eligible for services under another program (e.g. VA, AFDC, SSI). In such cases, clients receive "similar benefits" -- services prescribed by VR but paid for by another state/federal agency. Even though these services can contribute to a client's success in the program, the value of similar benefits is not included in the total service cost figure reported on the R-300. Efforts to remedy this deficiency are presented in the second section.

Similarly, there is no specific accounting for counselor services. Under present cost reporting, counselor input must be treated as a component of overhead. This treatment is defensible only if the quantity of counselor time spent per client was uniform across clients regardless of the nature of their impairment. An attempt to incorporate counselor time on an individual client basis is presented in the third section.

The conceptual framework of this chapter will be to take the direct costs of services provided (see Table 12-1) and to allocate them on an individual client basis. It is then possible

to get an accurate assessment of the services received by the clients for the purposes of estimating benefit-cost ratios.

Table 12-1

ALLOCATION OF VIRGINIA DRS COSTS
FISCAL YEAR 1982

DIRECT COSTS:		
CASE SERVICES	$12,997,650	
SIMILAR BENEFITS	$5,183,219	
COUNSELORS	$3,728,250	
		$21,909,119
INDIRECT COSTS:		
EVALUATORS	$571,665	
SUPERVISORS	$1,168,650	
FIELD SUPPORT	$7,234,815	
		$8,975,130
ADMINISTRATIVE:		$1,920,675
TOTAL		$32,804,924

Enhanced Service Cost Data

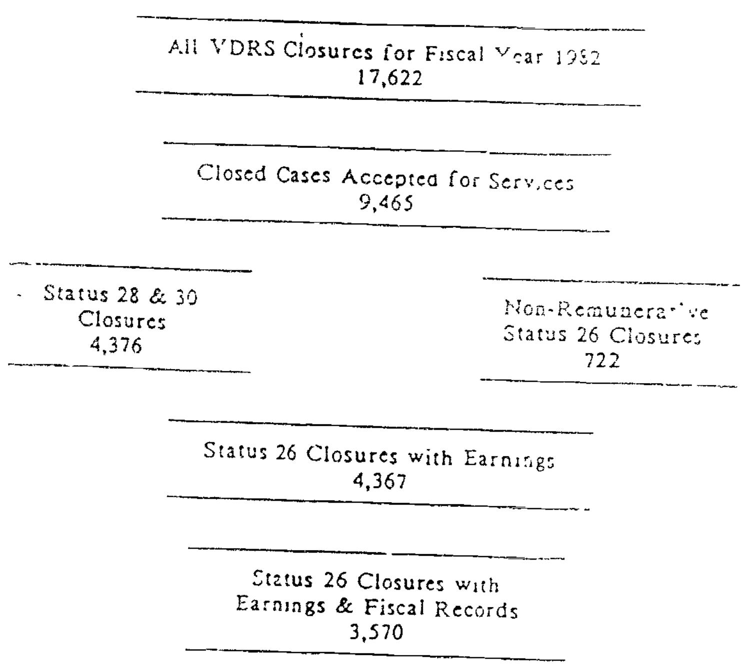
The data analyzed in this study reflect all closed cases for the Virginia Department of Rehabilitative Services (VDRS) in 1982. This data set is more comprehensive than those typically available under the Federal R-300 reporting system because it contains matching demographic and service-specific cost files for each client closure. This accounting renders two significant improvements to the R-300 data. First, the data on service costs are more accurate because they are compiled from records of "vouchered" services (i.e., services actually paid out).

Second, client records containing individual voucher services permit analysis of the pattern of services received. This perspective differs from previous benefit-cost studies which relied on total service cost per client. Such an aggregative approach ignores the fact that services vary in their nature and intensity. Even broadly defined, the services to a client represent a mix of diagnostic, restorative, educational, vocational, and/or direct financial assistance. Studies which relate total service expenditures to earnings cannot reveal how the service pattern itself may influence outcomes. In terms of policy, how dollars are spent in a successful rehabilitation program is just as significant as how much is spent.

Figure 12-2 depicts the criteria applied in defining the target sample. While VDRS recorded 17,622 closed cases in 1982,

only 9,465 persons were accepted for either VR services (Status 10) or extended evaluation. The sample is further restricted by the condition that clients report earnings at closure. This condition eliminated two broad categories of closed cases. First, clients who are "unsuccessfully" closed usually will not report earnings. Second, even a "successful" closure does not necessarily imply remunerative employment. For example, a Status 26 closure can be achieved through such placements as homemaker or unpaid family worker. Together, these categories eliminated 5,098 clients -- 4,376 and 722, respectively. For most of the remaining 4,367 closures, service-specific cost files were available for any expense incurred during a four-year period prior to closure in 1982.

Figure 12-2



Defining the Target Sample

These fiscal files contained information on the specific type of service received as well as the frequency, date, and duration of services provided. Consistency checks of the data revealed that 797 clients did not have acceptable matching fiscal records. Loss of these 797 clients reflects two factors: (a) 348 cases closed in 1982 had costs incurred more than four years ago, beyond the longitudinal scope of our data; and (b) 449 did not receive any "contracted service," most likely implying that this group received only counseling and/or job placement services which are provided "in-house" and thus do not show up as a specific vouchered expenditure. These clients may also have received "similar benefits" -- services purchased by a non-VR agency. Loss of these observations left 3,570 clients in the sample.

In summary, the sample contained clients closed from the program with earnings and complete records of specific VR services provided. Since VDRS provides a total of 62 different contracted services, these services were grouped within five broader categories: (a) diagnostic, (b) restorative, (c) training, (d) education, and (e) maintenance, transportation and other. The client sample was also stratified according to the following modified RSA disability classifications: (1) physical impairment, (b) mental retardation, and (c) emotional impairment.

Distribution and Value of Service Receipts

Table 12-3 provides a descriptive overview of service-specific receipts. This table shows the number of persons receiving each service, the mean value of services, and the receipt rate within each disability category. The far right-hand column presents all-impairment figures for each service category and the bottom row reports the mean value of total service receipts across each disability group. For example, education is the most expensive service category, $2,024, while mentally retarded clients receive the highest average value of services, $2,112.

Table 12-3

Specific VR Service Receipts by Impairment Cohort

		IMPAIRMENT			
SERVICE	Variable Description	Physical (n=2180)	Mental Retard (n=876)	Emotional (n=514)	All Impairments (n=3570)
Restorative	Average Receipt	$1,206	$389	$517	$1,061
	# of Clients	1,471	212	128	1,811
	% of Clients	67%	24%	25%	51%
Training	Average Receipt	$541	$1,076	$751	$825
	# of Clients	301	406	229	936
	% of Clients	14%	46%	45%	26%
Education	Average Receipt	$1,586	$2,918	$1,732	$2,024
	# of Clients	291	191	148	630
	% of Clients	13%	22%	29%	18%
All Services	Average Receipt	$1,462	$2,112	$1,547	$1,633

The distribution of the remaining three service categories across clients varies predictably with disability type. For example, average restorative services of more than $1,200 were provided to physically impaired clients and at the relatively high receipt rate of 67 percent. In comparison, only 25 percent of emotionally ill or mentally retarded clients received restorative services, with a mean benefit value of $389 and $517, respectively. On the other hand, mentally impaired clients received the bulk of training services. Note that 635 of the 936 training service recipients were either mentally retarded (406) or emotionally ill (229), with a mean service value of $1,076 and $751, respectively. The receipt rate for training among the mentally impaired persons was almost fifty percent. Generally, these results reflect this cohort's need for personal or work adjustment training. In contrast, the average training service received by physically impaired persons was less that $541, with a receipt rate of only 14 percent.

The design of Table 12-3 has omitted two of the specific-service categories mentioned earlier -- diagnostic services and maintenance, transportation and other (MTO). The omission of MTO is based on the judgement that these expenditures tend to be of a supportive rather than rehabilitative nature. Diagnostic services were omitted because they are received by the vast majority of clients in our sample (71.7%) and in relatively equal amounts. Consequently, diagnostic services are unlikely to

surface as a differentiating variable in the rehabilitative process. However, one important fact is not revealed due to the truncation of Table 12-3 -- 588 of the successful closures in the sample (16.5) reported diagnosis as the only form of contracted VR services received.

Accounting for Similar Benefits

Another deficiency in the traditional cost-benefit analysis of the VR program is the lack of accounting for similar benefits in the cost of the service package received by clients. Recall that these are services that have been provided to a client of the VR agency but funded by another federal, state or private agency. From both a social accounting and individual client standpoint it doesn't matter who pays for the service. Moreover, a counselor may work just as hard to procure these services as they do for those purchased by the agency or provided "in-house".

To get some estimate of the magnitude of the problem, consider that for 1982 the amount of services purchased by the VR agency totalled just under $13 million (see Table 12-1). The estimated cost of the similar benefits provided during the same period was over $5 million. Some 30% of services received by clients are overlooked in a cost framework that only examines those services purchased by the VR agency.

By neglecting to include these similar benefits in an estimation of the impact of services on outcomes one encounters

an omitted variables bias. This will present two different types of problems. If these benefits are distributed equally among the clients then the resulting analysis will overestimate the impact of the purchased services. If these services are not evenly distributed then this will bias the impact of the reported services. To avoid these problems requires an aggregation of both VR-purchased and similar benefits on an individual client basis.

In order to incorporate data on similar benefits it is necessary that these services be made compatible with existing cost of service data. The R300 data set categorizes the services received by a client into 12 different categories. If one of the services is received it is designated as being provided with cost to the agency, without cost or shared cost. The latter two classifications represent similar benefit provision. The former means that an outside agency paid for the entire cost of the service while the latter implies some cost-sharing between the VR agency and an external funding source. If the outside agency funded all of the cost of the service then there would be no record of this service cost on the R300 file. If there was a sharing arrangement this means that only that portion of the service funded by VR was recorded; the actual cost of the service is not provided.

The breakdown of the services received in this schema are

presented in Table 12-4. In only two service groups - maintenance and business school - were external funding sources used to provide services for <u>less</u> than one-third of the clients receiving such services. For six of the 12 categories <u>more than half</u> of the services received were funded at least in part by similar benefits. For instance, the two most popular services provided, diagnostic and "other" services, were funded by other agencies for 62.3 and 95.6% of the clients.

Table 12-4

VR-PURCHASED SERVICES AND SIMILAR BENEFITS

SERVICE	NUMBER OF CLIENTS RECEIVING	NUMBER RECEIVING PAID BY VR	NUMBER RECEIVING SIMILAR BENEFITS	PERCENT RECEIVING SIMILAR BENEFITS
DIAGNOSTIC	9118	3436	5682	62.3%
RESTORATIVE	3444	2264	1180	34.3%
COLLEGE	561	348	213	38.0%
OTHER ACADEMIC	331	49	282	85.2%
BUSINESS SCHOOL	168	116	52	31.0%
VOCATIONAL SCHOOL	1005	525	480	47.8%
ON-JOB-TRAINING	262	96	166	63.4%
WORK ADJUSTMENT	1698	976	722	42.5%
MISCELLANEOUS	575	207	368	64.0%
MAINTENANCE	841	667	174	20.7%
OTHER SERVICES	4567	203	4364	95.6%
SERVICES TO FAMILY	65	24	41	63.1%

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Given the magnitude of the oversight of not including such costs, how can we correct for this deficiency? Many states keep at least cursory records on the dollar amount of similar benefits provided to their clientele. In Virginia, a record is provided by the counselor at the time the IWRP is drawn up of the estimated costs of the services that are <u>supposed</u> to be delivered. Note that these are not vouchered services. The record contains the type of service provided, the estimated dollar amount and if the service was funded by a governmental or non-governmental agency. These records are cumulated in a file that tracks all such services for a particular fiscal year regardless of closure status.

The cost data for our sample should include all similar benefits provided to the 9,465 clients closed during 1982. Unfortunately, the last year that the VDRS maintained a file for was 1982. Thus if a client received any similar benefits prior to the fiscal year in which they were closed out in, there will be no record of such service provision. Nonetheless, we were able to obtain the file for the year in which the client was closed.

There were a total of 5,882 records reported for this period totaling $5,183,182. The average value of a similar benefit was over $880. While one-sixth of these services were under $50, more than 20% of the individual services were valued at over $1000. In and of itself, this information demonstrates the

magnitude of the oversight. However, since these were just records of services and not tied to an individual recipient, the remaining task was to try to combine these files with the existing augmented R300 data base.

The process of merging this data with the file of VR-purchased services was filled with numerous pitfalls. The similar benefit file contained records for clients who were still active in the program. These records could not be used. A significant portion of the closed cases received no similar benefits. Many clients received more than one similar benefit and thus multiple records were generated for them. These files had to be combined into a single file in order to match the VR-purchased data.

After these problems were resolved, a merged file was created that contained the similar benefit information for the cases closed in 1982 that had received any services. A total of 3,174 clients received some similar benefits in 1982, roughly one-third of the entire sample. Since there are over 50 different services purchased by external funding sources, these were grouped into the diagnostic, training, education, restoration, and maintenance, transportation and other categories to make them comparable to the VR-purchased services. The amounts of each category received by the sample are reported in Tables 12-5 and 12-6.

Table 12-5

AVERAGE VALUE OF THE SIMILAR BENEFITS RECEIVED
IF A CLIENT RECEIVED ANY SUCH SERVICES
(N=3174)

Service Received	Average Amount Received
Diagnostic	$204.00
Restorative	$461.00
Educational	$254.00
Training	$406.00
Maintenance, Transportation & Other	$210.00
Total	$1,535.00

Table 12-6

VALUE OF SIMILAR BENEFITS RECEIVED

Service Received	Number of Clients Receiving	Average Amount Received	Total Amount Received	Average Services As a Percent of Total Services
Diagnostic	138	$4,707	$649,610	52.60%
Restorative	1468	$996	$1,462,580	11.13%
Educational	686	$1,174	$805,310	13.12%
Training	1051	$1,227	$1,289,600	13.71%
Maintenance, Transportation & Other	787	$845	$665,330	9.44%
Total			$4,872,430	100.00%

There are two ways of examining the results of this procedure. First one could investigate the impact of incorporating similar benefits into the accounting of services for the average client who received any similar benefits. Note that the average value of restorative and training services was over $400. Diagnostic, education and maintenance, transportation & others were each more than $200. The sum of these services, again for the average client, was in excess of $1,500.

The other way to look at the impact of similar benefits is to concentrate on those clients who received a particular service. Only 138 clients received diagnostic services that were at least partially funded by an external agency. However the average amount received was quite high - some $4,700. These clients received one-eighth of the total estimated expenditure for external agencies during 1982.

The most frequently received service was those categorized as restorative in nature. Almost 1500 clients, just under one-sixth of the entire sample, received some $1.5 million of restorative services that had previously been unaccounted for. This turns out to be just under $1000 worth of services for these clients that do not show up in an R300 cost accounting. To put this underreporting in its proper perspective we note that the entire VR-purchased expenditure for restorative services was $4,108,417. Over one-third of the restorative services received by a client in dollar terms are not reported.

The most expensive service, and thus one whose absence should cause the greatest distortion in prior analyses, are training services. In excess of 1,000 clients received almost $1,300 of such services. Finally, the impact of externally funded education and maintenance services should not go unnoticed. The value of externally-funded educational services was almost $1200 while maintenance and other support services valued at almost $850 were provided to clients.

Counselor Services

The third component of the VR menu of services for which no specific cost accounting is done concerns the value of counselor services. Since this service dimension is treated as a component of overhead, it is difficult to assess the cost-effectiveness of counselor time spent with the client. Although one should not extrapolate too far from a single datum, it is remarkable that roughly one in every six clients closed from the program with improved earnings received only VR-purchased diagnostic services. This finding suggests that, for purposes of program evaluation, current accounting procedures mask the conceivably major contribution of counselor services in the VR process.

The emphasis of this section is to get a grip on counselor time and attempt to monetize the value of such services on a per client basis. It is then possible to compare the marginal impacts of counselor services on client outcomes in the same

fashion that we examine purchased services. We will examine various ways of allocating counselor time, suggest one possible formulation using our enhanced state data base and see in what respects this measure is still inadequate.

There have been numerous "cookbook" methods suggested to allocate counselor costs in the absence of individual counselor caseloads. As Collignon has noted,

> The alternative allocation procedures are in terms of the percent of such clients in the total case mix (which assumes each client generates the same time requirements for counselors), the ratio of the average case service costs for the client group to the cost for the average rehabilitant (assuming that counselor time is most heavily influenced by the complexity of the service plan required by the client), and the ratio of the average time in process for the client group compared to the average rehabilitant (assuming that counselors spend the same time per client each month).

The problem with these methods is that there is no indication of the intensity or actual duration of the counselor time provided. All that can be gleaned from the R300 file is the total cost of purchased services and the elapsed time spent in various service statuses. Incorporating the aforementioned methods will lead to serious biases in the estimates. Given existing national data, there is no way of determining whether the counselor is merely serving as a broker of purchased services for the client or instead is actively providing guidance, job placement and the like to the individual client. Moreover, the fact that a client receives many purchased services or is in a particular status for many months does <u>not</u> indicate that the

counselor is providing his or her time concomitantly.

The augmented Virginia R300 data base has some additional information that gives some insight into counselor time per client. On each client record is the identification number of the counselor coordinating the service provision. This enables us to obtain the size of the individual counselor caseload. With this information and the assumption that each counselor provides the same amount of time to each client in their caseload, we can get a crude proxy of counselor costs per client. Of course such an estimate cannot discern the amount of client contact time, which is the true measure of intensity.

It was determined that the average counselor served 60 closed cases during 1982. On an average annual salary of roughly $20,000, an hour of counselor time is valued at $10 per hour for a 2,000 hour work-year. Dividing the salary by the number of clients served obtains $330 of counselor services for the average counselor. For the counselor with larger caseloads the cost per client will decline. Thus for the clients in the counselor caseload of 211, the average amount of counselor time received would be valued at less than $100.

Given that this procedure is based only on closed cases and that it cannot distinguish among time differentials for individual clients, such an estimate is only marginally better than previous estimates. However, it is an important first step in deriving the total cost of services provided to the individual

client.

Conclusion

Vocational rehabilitation programs provide a variety of different services, funded by numerous agencies, to a group of clients with vastly dissimilar capabilities. Given the host of services and their disparate nature, it is reasonable to think that the provision of these services will have different impacts. The current federal reporting system does not examine the individual components of the program, nor does it provide estimates of the level of externally funded services or of counsleor services provided within the agency.

This chapter has addressed methods to obtain the true costs of services provided to individual clients of the vocational rehabilitation program. This entails developing augmented data bases available from individual states. Using data from Virginia, an enhanced data set was constructed which included specific services, estimates of similar benefits and a proxy for counselor services.

From these three sources it was determined that the average client received over \$1600 in services purchased by the VR agency, over \$1,500 in externally-funded services if they were eligible and over \$300 in counselor services. By adding the components it is possible to obtain the actual costs of the

services provided within the VR framework. This will enable the analyst to get a clearer picture of the costs and benefits associated with this program.

Chapter 13

USING BETTER MEASURES OF DISABILITY STATUS

David Dean and William Milberg*

Introduction

The purpose of this chapter is to demonstrate the additional analytical precision obtainable with the use of an augmented state VR data base compared to analysis using the standard federal R300 reporting system. The federal R300 data base includes information on client demographics, a condition classification of client impairment and types and the duration of services received. There are numerous shortcomings to such a data base as noted in detail elsewhere in this volume.

The enhanced state data base employed in this effort includes all the information from the federal reporting system, plus valuable information on the dollar amount of services received by each client. In addition, the Wisconsin VR Agency sample contains a new operationalization of health or functioning, called the Functional Assessment Inventory (FAI).

The new state data base enhances our ability to perform cost-benefit analysis of the VR program. Specifically, the information on dollars expended on particular services enables us to draw conclusions about the differential impact of service

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utilization patterns. In addition, the FAI data permit a specification of functioning superior to that used in other studies. This allows us to statistically control for health or functioning in our estimate of the impact of VR services on client outcomes.

The chapter is organized as follows. Section I presents the standard earnings equation specification and discusses its enhancement with the inclusion of a health variable. We will then discuss alternative conceptualizations of health, including the FAI. Section II provides a full description of the Wisconsin VR Agency data set and a description of the variables used in our specification of the earnings equation. Section III presents results of estimation of the earnings equation using alternative formulations of the health variable. Our results show conclusively that the factor analytic transformation of the FAI data gives the greatest explanatory power in determining the impact of services on client outcomes. The concluding section presents areas of further refinement in research into functioning indices.

I. Earnings Equation Development

There are numerous benefits that one can ascribe to the vocational rehabilitation program. Using a formal cost-benefit framework (Chapters 3 and 4), these benefits can be measured in terms of changes in health status, job adaptability and earnings capabilities. These models incorporate measures such as the <u>change</u> in functioning or the <u>change</u> in earnings as outcome measures with which we can then compare the efficacy of the menu of services provided by the rehabilitation process. Such a framework entails a longitudinal study which requires measures of pre-program earnings and functioning levels, services received during the course of the program and post-program earnings and functioning levels.

Current data collection methods employed within vocational rehabilitation agencies do not support these types of research endeavors. The deficiencies in the earnings data at referral (Chapter 8) and closure from the program (Chapter 9) have been investigated elsewhere in this volume. A much more serious shortcoming is the lack of a measure of the change in client functioning after completion of the prescribed program. With only a measure of client functioning at program referral, and a crude one at that, it becomes all but impossible to <u>meaningfully</u> estimate the impact of the regimen of services provided to individuals.

For instance, consider two individuals with identical observed characteristics, program treatment and initial functioning levels, but one client has a markedly higher functioning capability upon program completion. This results in earnings levels of $150 and $250 per week respectively. In the absence of a measure of post-program functioning, the use of standard econometric techniques could not account for the difference and it would be assigned to the random error term and any other variables correlated with functioning.

Nonetheless, these potentially fatal variable omissions have not daunted economic inquiries into the vocational rehabilitation program. The typical economic treatment (Bellante, Conley, Worrall [1977]) has proceeded with the implicit assumption that the change in functioning is proxied by the change in client earnings. These studies have then attempted to statistically control for the <u>initial</u> level of functioning by incorporating the RSA R-300 condition classification format (e.g. heart condition, arthritis, mental retardation, etc.). While this measure was crude, and as we shall see - wholly unsatisfactory, it was the "only game in town" with which one could control for the level of client impairment.

The purpose of this endeavor is to improve upon this condition-classification measure used to control for health in an earnings equation framework. This will enable us to examine more concretely the impact of the specific services provided by the VR

agency. As Galvin et. al. have noted,

> Since functional assessment attempts to measure the actual performance of an individual while giving consideration to his or her environment, some program evaluators believe that functional assessment data may contribute to the demonstration of rehabilitation service outcome through the measurement of small gains as opposed to the absolute fact of employment. [Galvin, et. al., 1985]

In recent years there have been a spate of attempts by health researchers to operationalize the concept of health/functioning into a meaningful construct [Jette]. One such instrument has been the Functional Assessment Inventory (FAI). The remainder of this section will examine the necessity of controlling for health in an earnings equation, develop a taxonomy of health indices which may be suitable for such purposes, assess the deficiencies of previous attempts by economists to incorporate these measures and look at the merits and shortcomings of the FAI.

One can think of vocational rehabilitation as a manpower training program designed for persons who meet a specified disability criteria. The eligible client must have a medically determined disability which is a vocational handicap but which can be remediated through the provision of VR services. The typical economic treatment to quantify the impact of "poor health" for such persons has been to append the Mincer-Becker human capital framework. This consists of modifying the standard earnings equation to incorporate the services provided and to

"control" for the level of health in some fashion. Hence :

(1) $Ln\ Y = a + bK + cX + dH + e$

where Y is the individual's earnings, Ln is the natural log function, K is a vector of human capital variables including schooling and work experience, as well as vocational rehabilitation services, X is a vector of demographic and family background variables, H is the measure of the client's health or functioning status, and e is the random error incorporating unobserved variation and measurement error. Note that a, b, c, and d are the intercept and parameter estimates for the respective variables. Clearly, in the absence of a control for health this model suffers from omitted variables bias. This will increase the magnitude of e, rendering all parameter estimates less efficient and will also alter the magnitude of any parameter estimates whose variable is correlated with health. Our interest here, then, is in the proper specification of the client's health variable, not in a re-specification of labor supply models.

Typically, economists estimate labor force participation models (Does a person work or not?), labor supply models (How many hours per period does the client work?) or earnings equations (What was the client's hourly wage rate?). The RSA R-300 data set only provides information on weekly client earnings which is an amalgam of hours worked and the hourly wage rate. Given the paucity of data about client earnings, one should

interpret any results with proper skepticism. Thus we shall proceed to examine the various methods employed in previous studies to estimate health.

Recent economic inquiries into the impact of manpower training initiatives have utilized a "fixed effects" framework to estimate program benefits (Ashenfelter, Bassie, and see discussion in Chapter 3). In such a model, programmatic impacts of the "treatment" variable are isolated by examining the difference in earnings prior to and after program intervention. The prior earnings figure incorporates many demographic variables that are independent of the treatment variable. Unfortunately, with the dearth of information about pre-program earnings for most clients it becomes impossible to operationalize such a model in a VR setting.

Recognition of the need to include a health measure in the earnings equation begs the question of the exact specification this variable should take. Health is an amorphous concept and has received many different representations in the literature. Below we will discuss the ideal health/functioning measure. We then review past attempts to operationalize this construct. In presenting a taxonomy of health measures we are able to classify these previous efforts and identify their inherent shortcomings both conceptually and econometrically for the purpose of estimating an earnings equation. We will put particular emphasis

on deficiencies with the measure currently used by VR agencies to classify client disability. We will conclude the section with a discussion of the merits and drawbacks of the Functional Assessment Inventory, the variable incorporated in our augmented state data base model.

A. Past Attempts To Operationalize Health

Above we discussed the need to control for health/functioning in an earnings equation. Having established this need, we turn now to the problem of creating a conceptually appropriate and administratively feasible health/functioning variable. The appropriateness of a given measure will of course be determined by the question we seek to answer, in this case the impact of VR services on client earnings. The "search for a health variable" has gone on for decades, and will no doubt continue to go on as the questions we seek to answer requiring a health variable change.

The first problem in creating a health variable is defining health. This problem is not trivial. According to Goldsmith, "This difficulty of conceptualizing health is perhaps the major constraint on the development and usefulness of health status indicators."[Jette] Health is defined either according to an assessment of medical condition or of functioning. Of course each of these conceptions of health may be defined in many different ways. For example, medical diagnostic measures could

vary from the dichotomous mortality indexes often used in economics studies [See Parsons] to the over 100 condition classifications used to categorize the disabled by the RSA. Moreover, the latter conceptions of health - functioning - may be refined to account for different levels of functioning, e.g. from the level of independence at home (ability to dress, toileting, etc.) to the ability to interact well with others in the workplace. Defining health, then, is not a trivial issue, and is the first step in creating a health variable.

The first link in the chain of health is a condition classification, a medical diagnosis of a physical, mental or emotional ailment. Such a condition may result from what Whitten refers to as a "pathology" [Lambrinos]. "Pathology ... may be the result of infection, metabolic imbalances, degenerative disease processes, trauma, or other etiology." A diagnosed condition may lead to an impairment, depending on the severity of the condition. Level two is impairment, which indicates "a physiological, anatomical or mental loss or other abnormalities." An impairment may lead to a functional limitation, defined as an inability to perform physical, mental or emotional activities. The World Health Organization (WHO) definitions are almost identical except for differences in nomenclature. Stewart defined functional status as "the performance of (or the capacity to perform) a [illegible] of activities that are normal for people in

good physical health." There are five categories of functioning: self-care activities, mobility, physical activities, role activities (work, school or household activities) and leisure activities [Stewart]. We would simplify this taxonomy and distinguish "role activities" as job activity limitations. The four other categories we define as basic activity limitations. The WHO labels as disability what we call functional limitation.

It is likely that if one is limited in the ability to perform basic activities, one would also be limited in job activity functioning. The converse is not true, of course, since job activities usually require functioning beyond, or at least different from functioning required for basic activities.

Level five in the chain of health is disability or handicap in WHO terms. Disability is not an absolute category. It depends on social norms and economic factors as well as an individual's job activity limitations. We cannot draw a one-to-one correspondence between a functional limitation and a disability. For example, the same back problem endured by President Kennedy while in office might render a dock worker completely disabled [Berkowitz, Nagi, Lambrinos]. The "chain of health in society" is summarized in Figure 1.

FIGURE I

The Chain of Health in Society

ETIOLOGY

WORK INJURY — CONGENITAL DYSFUNCTION — CHRONIC DISEASE

CONDITION CLASSIFICATION (Level 1)

- -- RSA R-300
- --Bartel and Taubman

IMPAIRMENT (Level 2)

FUNCTIONAL LIMITATION

ACTIVITY LIMITATION (Level 3)

- --LFI
- --PULSES
- --RAND
- --Barthels
- --FLS
- --Skill Indicators
- --PSFS
- --Moskowitz and McCann

JOB ACTIVITY LIMITATION (Level 4)

- --FAI
- --PDQ
- --Index of Well-Being

DISABILITY (Level 5)

- --Health Insurance Study
- --Social Security

B. Operationalizing Health Via a Functioning Scale

The question of how to create a conceptually appropriate health variable can be rephrased as follows: At what point in the chain do we seek to measure health? Deciding on this narrows considerably the field of appropriate health variables. For the analysis of the impact of VR services on client earnings. we seek a measure of health assessing job activity limitations, that is that assesses health at level 4 in Figure 1. Such a scale would thus not necessarily evaluate health status at levels 1 - 3 and certainly not assess the existence or extent of disability (i.e. level 5). Health measured at levels 1 - 3 would probably not pinpoint aspects of health most relevant to an assessment of vocational capability and thus earnings.

There are many examples where medical illness would be irrelevant in explaining employability and earning~. For example, according to Crewe and Athelstan [1981, p. 299]:

> ...identifying a person as having a closed head injury does not tell a counselor whether the individual can speak, walk, handle perceptual tasks, or remember events from one hour to the next. Furthermore, such a medical diagnosis says nothing about the ability to relate to other people, vocational skills, or the environmental system. Functional assessment, on the other hand, can pinpoint such problems and can also call attention to the similarities among some clients with different diagnoses.

Health measured at level 5 would assess too narrowly a client's vocational status. That is, the step from level 4 to level 5 involves the imposition of very specific social and

technological factors closely associated with particular jobs. It is only at the 5th level that President Kennedy and the dockworker would be assessed differently, in the example given above, that is the dock worker is disabled, while JFK is not. Our analysis of VR services is interested in health functioning related to work in general ways. We seek to isolate (and remove) the sociological element in assessing the influence of functioning on earnings. Such an assessment would provide the most appropriate health measure for determining employability and earnings potential. A particular disability may be overcome with the provision of VR services. Thus knowledge of such a disability may be a misleading indicator of the impact of health, per se, on future labor force participation.

The ideal health variable depends crucially on the context in which it will be used. Bartel and Taubman saw fit to define "an ideal health construct...as one that measured on some continuous metric all bodily or biological functions." Clearly they seek a level two variable in our schema. Since we are interested in investigating vocational limitations of clients receiving rehabilitation services, we seek a measure at a higher level in the "chain." Berkowitz has defined an ideal health variable more suitable for our analysis:

> Ideally the variable we seek should be quantifiable, continuous, not dichotomous, independent of the requirements for a particular job, relevant to the requirements of functioning in the labor market, independent of the decision to participate or not participate in the labor force, and feasible.

Like Berkowitz, our ideal health variable would be at the fourth level in the chain, that is one measuring job activity limitation. Job activity limitation is the proper specification of the health variable for estimating the impact of VR services on labor market outcomes. A measure of disability (level five) would be too specific, in that it incorporates socio-economic elements that are not necessarily related to the functional limitation which is most relevant to labor market outcome.

Most existing health indexes assess "health" at our assigned levels 1, 2, or 3. One type of index used which fits in at level one in our configuration are mortality indexes [Parsons]. While such measures have the virtue of not being endogenously determined, there are numerous drawbacks which make them unsuitable for our purposes. By their very nature mortality indexes are very crude, binary in nature, and also ignore all non-fatal dysfunctions. Moreover, we have a cross-sectional, rather than a longitudinal data set which requires that we examine differences across individuals, effectively eliminating mortality measures from consideration.

Another example of a level 1 health index is the RSA condition classification scheme. This health variable classifies each client according to over 100 medical conditions as defined by the RSA. That the variable is not the most appropriate for our analysis is evidenced by the earnings equation estimates

presented below using alternative health variables.

There are numerous deficiencies with the condition classification scheme used by the RSA in determining client impairments. First, as Bartel and Taubman noted with regard to their index - the presence of a doctor's diagnosis of a particular disease:

> Our measure of health differs from the ideal one in several ways. First, we have no indication of severity other than the passing of some threshhold, and we do not know if there have been any cures or remissions. Second, a person can be ill without being so diagnosed. Third, a diagnosis can be wrong. As is well known, random measurement error, if uncorrelated with the true independent variables, will bias coefficients towards zero.

A second difficulty with this measure is that while it is exogenously determined by a physician, there is no attempt to get at the vocational limitation caused by the condition. For our purposes, we are solely concerned with an inability to engage in various aspects related to work, regardless of their etiology. Different clients may have the same functional limitation i.e restricted use of an arm, with varying causes of the limitation. This limitation could be due to arthritis, an amputation, a musculo-skeletal injury, etc.. However, there is no way of knowing this under the existing index used by the VR agency.

A third problem with this format is that it cannot account for multiple causes or outcomes, except through the presence of a secondary condition. This mutual exclusivity effectively rules out interacting multiple impairments, which together are what typically cause the client's vocational limitation.

A final shortcoming of such a specification is that the binary nature of the condition classification

Many of the indexes that attempt to assess functioning do so at level 3, the level of activity limitations, as opposed to level 4, job activity limitations. The list of such indexes is long. Many of these, including PULSES, Barthels, the Functional Life Scale, the Programmed Summary of Functional Status, the Moskowitz and McCann index and Skill Indicators, measure functioning with respect to the so-called "activities of daily living" (ADL) [Halpern and Fuhrer]. A brief description of several of these indexes is helpful.

The main functions assessed by ADL measures are physical mobility, transfers, home chores, kitchen chores and personal care [Jette, 1980]. For example, the PULSES scale measures six categories of global functional status, where P stands for physical condition including diseases of the viscera and neurological disorders, U stands for self-care activities (drink, feed, etc.) dependent mainly upon upper limb function, L stands for mobility activities, dependent mainly upon lower limb function, S stands for sensory components relating to communication and vision, E stands for excretory functions and S stands for intellectual and emotional stability, support from family unit and financial ability.

The Rand Health Insurance Study functional status index goes

slightly beyond the simple ADL scales, combining a functional limitations battery (mobility, physical activities, role activities, self-care) and a physical capacities battery [Stewart]

The Sickness Impact Profile also goes beyond the standard ADL measure. But this instrument has been criticized for its imprecis--- According to Jette, it "us:s multiple functional activities within the same question which may be performed at different levels of function." [Jette]

Crewe and Athelstan's Functional Life Scale essentially assesses level 3 functioning. According to Crewe:

It can be used to provide a quantitative measure of an individual's ability to participate in all the basic daily activities which are customary for the majority of human beings. The areas assessed include cognition, activities of daily living, home activities, outside activities and social interaction. The scale appears to be very promising as a means of assessing the overall affectiveness of a rehabilitation program in returning an individual to everyday life. It does not deal with many of the factors which would be most relevant for determining employment potential, however. For example, a diabetic might score well on this scale and still face great problems in finding work." [Crewe]

There are several deficiencies in utilizing these activities of daily living scales as a health construct in an earnings equation specification. One major shortcoming is their emphasis on physical functioning and mobility which neglects many of the mental and emotional aspects of vocational functioning. Given the high percentage of vocational rehabilitation clients who experience the latter forms of dysfunctioning, this would render

ADL scales inappropriate for our purposes. Moreover, as Barkowitz has noted, there is not necessarily a correlation between inability to perform such ADL skills and ability to hold down a full-time job. Remember that we desire measures which measure a VR client's functioning with respect to vocational limitations.

Level four is the level at which we would define our ideal health variable. Several measures have been constructed to assess this type of health/functioning. These include the Functional Assessment Inventory (FAI), the Index of Well-Being and the West Virginia Preliminary Diagnostic Questionnaire (PDQ). Our study employs the FAI. A brief review of these level-four scales is thus helpful.

The FAI was designed to aid vocational rehabilitation counselors who must work with clients who may have a broad range of disabilities. Since counselors may not be aware of the consequences of various disabling conditions, the FAI seeks to summarize the pertinent vocational aspect of a disability. Thus, while it is largely diagnostic, it is concerned with vocationally related functions. According to Crewe and Athelstan, its originators:

> The FAI was developed to provide an accurate description of client potential for vocational planning...It identifies strengths and limitations that may or may not be modifiable but which need to be taken into account in developing a rehabilitation plan. [Crewe and Athelstan]

The two strengths of the FAI vis-a-vis the other measures we have examined are that it is counselor assessed and that it examines emotional and mental functioning. As a counselor - assessed measure of vocational limitations, the FAI avoids the endogeneity problem that arises with self-assessed measures and the problem of the exceedingly narrow focus of physician - assessed measures.

The problems with the FAI are three-fold. First, administration of the FAI requires extensive knowledge of the client on the part of the counselor. This may cause problems of the general applicability of the Inventory as well as its inter-rater reliability. Second, its virtue as a diagnostic tool to assess a variety of disabling conditions also leads to occasional lack of specificity in assessment. For example, the FAI contains only one question about vision, while there exist measures with a battery of questions relating to many different aspects of visual acuity. Related to this problem is the third shortcoming of the FAI. The scaling of responses is limited to four discrete values (zero to three) which may lack desired sensitivity of the degree of functioning.

The Index of Well-Being is more sophisticated yet, for our purpose, less useful than other indexes that assess health at level 4. This instrument asseses the level of physical dysfunction in physical activity, mobility and social activity. It also assesses expected future functioning. According to

Jette:

> They define health as the product of (expected values) of the social preferences assigned to levels of function and the probabilities of transition among the levels over the life expectancy of the individual or group. [Jette, 1980, p. 572]

The speculative element in this instrument distinguishes it from others, yet makes it inappropriate as the basis of an explanatory variable in an earnings equation.

The Preliminary Diagnostic Questionnaire attempts to assess the functional capacities of a person in terms of employment, that is level 4 functioning. In general, it covers cognitive functioning, physical limitations, emotional functioning, motivation and social, economic and personal conditions. [Moriarty] It covers essentially the same areas as the FAI. The two instruments differ, however, in that the PDQ relies heavily on self-reported evaluation while the FAI is strictly counselor assessed. The problems inherent in a self-assessed measure are discussed below.

The final level (level 5) in our chain of health/functioning is disability. The problem with incorporating measures of disability in our scheme is that what is observed is the interaction of the complex nexus between socioeconomic, demographic and functional limitation variables. The most prevalent health measures used in early economic analyses were those that were gleaned from available surveys such as the Health Insurance Study and the Social Security Survey of Disabled and

Nondisabled Adults. These health measures consist of measures such as the "number of bed-disability days" or "restricted days" as well as self-rated work limitations and declarations of health as "excellent", "good", "fair", or "bad". As Lambrinos notes, exogenous health indexes can be created from any of the five levels we have defined, <u>except</u> for disability. Such disability measures do not reflect an individual's level of well-being but rather their occupational status or taste for work.

One of the major flaws with such measures is that they cannot objectively discern between differences in health levels. Two individuals with vastly different functional capabilities may declare themselves equally work disabled because they face differing economic opportunities and constraints. Thus, there is no indication of the actual severity of the impairment underlying the perception of health. In specifying the earnings equation with such a health measure there will be a great deal of heterogeneity, resulting in large amounts of uncontrolled variation.

In the same vein, the fact that two persons with the same "true" health level may view themselves in different status of well-being, or that one person rates themself "limited in kind or amount of work" while the other perceives that they are "unable to work altogether" makes self assessed measurement inappropriate as a control for health in the estimation of an

earnings equation. Moreover, as Chirikos and Nestel observe:

> A more significant flaw is that behavioral measures of health are not necessarily independent of the labor force behavior that they are supposed to explain... Thus the behavioral evidence used to document poor health or classify the population under study as "disabled" may be identical to the behavior to be explained, namely, reductions in labor supply.

As other economic studies [Lambrinos,Parsons] concerned with the labor force participation decision of disabled persons have shown, socioeconomic conditions may induce a person to declare themself in poor health. The problem with incorporating such measures into an earnings equation specification is that they result in simultaneity bias. Inclusion of such health measures alter the magnitude and significance of the desired parameter estimates being investigated.

C. Other Criteria for a Health Variable

In the first part of this section we mentioned two criteria that should be used to evaluate health indexes. The first, that it measure health at the appropriate "level" we have discussed in some detail. The second, that it be administratively feasible, in terms of time, money and assessor training, deserves discussion. For one, we seek a measure which can provide empirical data for large samples, at a low cost. The instrument should not take too much time to administer. The skill level of the assessor is also important. Self-assessed instruments create potential endogeneity problems, discussed below. Physician-

assessed instruments tend to be those aimed at medical diagnosis. Counselor-assessed measures are thus most appropriate for labor market studies. It is also important that training of the assessor (be it physician or counselor) not be too time consuming or costly. Of course, the instrument should also exhibit significant inter-rater reliability.

III. Data and Variable Description.

The sample data set, forwarded to us by Abt Associates, was collected by counselors from the Wisconsin Division of Vocational Rehabilitation Services, for clients entering the program from March through July of 1981. During this interval, 1,670 program participants were surveyed. The data set includes specific services delivered to each client (in dollars) as in Chapter 12 and the counselor-administered Functional Assessment Inventory, in addition to the usual client demographic and programmatic characteristics.

This data set differs from the standard RSA-R300 reporting system in another significant aspect. The R300 data contains information on all clients terminated from the VR program sometime during the fiscal year. For this "customized" Wisconsin sample,the data gathering process was stopped at the end of September 1983, irrespective of closure status. As a consequence, the sample included clients of different status in the program.

Specifically, some of the clients surveyed were still receiving services and were designated as still active in the VR program. Those clients no longer active in the program were assessed either to have successfully completed the program by being suitably employed for a minimum of 60 days after receiving

rehabilitation services, or unsuccessfully completed the program. Of the 1,670 clients sampled, 524 (31.4%) were still active in the program, 782 (46.8%) were successfully rehabilitated and 364 (21.8%) were not rehabilitated.

The decomposition of the data set by VR program status is important because analysis of the impact of services on earnings requires client earnings data upon completion of the program. Clients who were still active in the program can obviously not be included for the purpose of such an analysis. Also, earnings at closure were not reported for those clients who unsuccessfully completed the VR program. Unfortunately, they must also be excluded from analysis of the benefits of program services on earnings, even though they may obtain demonstrable gains from the program.

While we must exclude the actives and non-successes from the earnings equation estimation, there was no reason to exclude them from estimation of a health/functioning variable. There is ample evidence that non-successes eventually report earnings [See Chapter 9, RSA-SSA data link]. Furthermore, those clients who were still receiving services will at some point be closed out of the program either successfully or unsuccessfully, and therefore may eventually report earnings. Using the information on the health status of <u>all</u> clients should thus not bias the estimation of the impact of the health variable on the reported earnings at

closure of successful clients.

On the other hand, non-successful clients and those who were still active in the program may differ in socioeconomic and demographic variables from those successfully rehabilitated. Significant differences in these variables may indicate both systematic and unobservable variation. Each of these variations present problems in estimating service impacts on earnings.

If there is unobservable variation among subsamples, i.e. motivation to work, perseverance, etc., then the estimated impacts of the explanatory variables on earnings may be significantly biased. The fact that a client was still active means that the duration of services received was greater than for a client in the other sub-samples. A client receiving services over a long period of time, e.g. education, may differ unobservably as well as systematically from a client receiving surgery or training.

For instance, the education of the father of the client is an unobserved variable (to the researcher) that may have some bearing on the earnings level of the client. It is not unreasonable to think that clients receiving a college education may differ in this unmeasured element from clients receiving work adjustment training. To attempt to estimate earning impacts of services without accounting for the difference in unobservables among the cohorts is unsound.

Second, if we find that the averages of the variables are

different among the subsamples, one can conclude that these cohorts were not randomly assigned. Hence, it is inappropriate to use the estimates of the impact of service variables on earnings for one subsample to draw a conclusion about their impacts on the other subsamples. This requires that we analyze the difference in the sub-samples for all the variables that are traditionally incorporated in earning equation estimations.

The demographic and socioeconomic characteristics, RSA and FAI disability classifications as well as services received for the sample of 1670 are presented below. They are described briefly first for the total sample, then for sub-samples distinguished by VR program status, i.e. those who succesfully completed the program (status 26), those who did not complete the program (status 28 or 30) and those still active, receiving services (status 10-24). For each variable we performed a test of significance of the difference of means across sub-samples. These results are presented in the tables below. We will also briefly discuss the expected impact of each variable on client earnings.

Demographic Variables

The demographic variables include client age at referral, race and sex. Table 13-1 summarizes the mean values for the full sample and by program closure status.

TABLE 13-1

TESTS OF THE DIFFERENCES IN MEAN VALUES FOR DEMOGRAPHIC VARIABLES AMONG THE THREE COHORTS: SUCCESSES, NON-SUCCESSES AND STILL ACTIVES (FROM A SAMPLE OF 1,670 CLIENTS OF THE WISCONSIN DRS)

DEMOGRAPHIC VARIABLES	MEAN VALUES FOR THE FULL SAMPLE (N = 1670)	MEAN VALUES FOR SUCCESSES (N = 782)	MEAN VALUES FOR NON-SUCCESSES (N = 364)	T-STATISTICS FOR THE TEST OF DIFFERENCES IN THE MEAN	MEAN VALUES FOR STILL ACTIVES (N = 524)	T-STATISTICS FOR THE TEST OF DIFFERENCES IN THE MEAN
AGE AT REFERRAL (YEARS)	30.2	31.9	30.3	2.00 *	27.8	6.20
RACE (% WHITE)	92.7	94.0	87.1	3.53 *	94.7	0.51
SEX (% MALE)	62.4	62.5	61.5	0.32	62.7	0.09

* Denotes difference at the 5% level of significance between the successful cohort and the non-successful and the still active cohorts respectively

Age

The average age of the clients in the total sample was fairly young -- just over thirty years -- with almost 38% being less than 24 and just over 15% greater than 45 years of age. The sub-sample of successfully rehabilitated clients had an average age that was significantly higher (almost 32 years) than both the non-successes (30 years) and those clients who were still receiving services who averaged 28 years of age. (See Table I on demographic characteristics). Not only is the average age lower for the actives, but the age distribution of this sub-sample is more skewed toward lower ages than the others. Specifically, over 75% of the actives were under 34 , compared to only two-thirds for the other sub-samples. As other characteristics will also illustrate, the sample of clients still receiving services are invariably receiving some educational services and thus it is not surprising that they may be younger.

Traditional earnings equations [Mincer] based on human capital theory have posited that the impact of age on earnings should be quadratic. This implies that as a person gets older one can expect to experience increased earnings but that they will increase at a decreasing rate. In other words, the rateof increase in earnings declines as one ages and the accumulated stock of human capital "depreciates". For a clientele that is predominantly mentally impaired, the expected impact of age on earnings is less certain.

Race

Almost 93% of the clients sampled were white. The total sample is comprised of successful and still-active sub-samples that were some 94% white and the non-successes which were only 87% white. There was a statistically significant difference between the successes and the non-successes. Thus while the active and success sub-samples may be drawn from the same sample in regards to this one variable, the non-successes exhibit a significantly different racial composition than the other cohorts.

The impact of race on earnings has been the subject of countless economic inquiries. Due to factors such as lower investment in human capital, discrimination, and the like it has been found that earnings of blacks are lower than whites, ceteris paribus. The expected sign of "blackness" on earnings is then negative.

Sex

Over 63% of the clients sampled were male. Both successfully rehabilitated and the still-active cohorts contained virtually the same percentage of males as the full sample. While the non-success cohort contained relatively more (1%) females, this did not represent a statistically significant difference in comparison with the reference group of successful rehabilitants.

The impact of gender on earnings has also been the subject

of numerous economic studies. The findings from such studies are that women earn less than men. Differences in earnings may be attributed to less work experience, lower investment in human capital, job discrimination as well as other factors. We expect to find an inverse relationship between "femaleness" and earnings.

Socioeconomic Variables

The socioeconomic variables include years of schooling completed, client marital status and reported earnings at referral to and closure from the program. The average values for the variables are presented in Table 13-2.

TABLE 13-2

TESTS OF THE DIFFERENCES IN MEAN VALUES FOR SOCIOECONOMIC VARIABLES
AMONG THE THREE COHORTS: SUCCESSES, NON-SUCCESSES AND STILL ACTIVES
(FROM A SAMPLE OF 1,670 CLIENTS OF THE WISCONSIN DRS)

SOCIOECONOMIC VARIABLES	MEAN VALUES FOR THE FULL SAMPLE (N = 1670)	MEAN VALUES FOR SUCCESSES (N = 782)	MEAN VALUES FOR NON-SUCCESSES (N = 364)	T-STATISTICS FOR THE TEST OF DIFFERENCES IN THE MEAN	MEAN VALUES FOR STILL ACTIVES (N = 524)	T-STATISTICS FOR THE TEST OF DIFFERENCES IN THE MEAN
EDUCATION (YEARS)	10.8	10.9	10.6	1.10	10.9	0.10
MARITAL STATUS (% MARRIED)	29.2	33.4	23.9	3.26 *	26.7	2.56 *
EARNINGS AT REFERRAL						
% REPORTING POSITIVE	12.8	20.3	12.3	3.54 *	1.7	12.02 *
$ AMOUNT, IF ANY	155.00	161.75	151.29	0.40	54.2	9.80 *
EARNINGS AT CLOSURE:						
% REPORTING POSITIVE	45.5	91.2	4.7	n/a	5.7	n/a
$ AMOUNT, IF ANY	n/a	160.08	n/a	n/a	n/a	n/a

* Denotes difference at the 5% level of significance between the successful cohort and the non-successful and the still active cohorts respectively

Marital status

For the Wisconsin sample, only 29% of the clients were married, approximately 50% were never married, while the remaining 21% were either divorced , separated or widowed. Once again, it must be emphasized that the sample consists of three heterogeneous cohorts. The cohorts differed significantly from the average for the entire sample with respect to marital status.

Over one-third of the successes were married. This statistically differentiates this sub-sample from the others, wherein roughly one-fourth of both cohorts were married. While the still-actives were more represented by never being married (almost 60% versus 44% for the successes), the non-successes had a higher degree of divorce or separation, 23%, which is almost twice the amount for those clients still receiving services.

Marital status is a variable that is typically included in labor force participation estimations but not in earnings equation estimations. The theory is that while being married will have some bearing on whether a person works or doesn't work, once that person chooses to work, marital status will not have any effect on the level of earnings. For a population that is predominantly mentally or emotionally impaired it may be that marital status is a proxy for compatability, committment, etc.. Employers may value such attributes in the wage offer determination. To the extent that these attributes have an impact

on earnings, we would expect marital status and earnings to be positively correlated.

Education

Most of the sample -- 61% -- had completed high school. About 31% had at least some high school, with the remaining 8% receiving either only elementary education or enrolled in a special education program. The average number of years of schooling completed was just under 11 for the entire sample, which was not statistically significantly different for any of the subsamples. More of the non-successes had only elementary school education. This would more likely make them candidates for work training programs rather than formal education. On the other hand, the still- actives tended to have a greater proportion with "some college", indicating that they may be more likely to receive college education as a service from the VR Agency.

The "returns to education" is another variable that has received considerable economic interest. It is generally thought that the impact of education on earnings is positive, but decreasing. This suggests a quadratic formulation of the years of schooling variable, similar to the relationship posited between age and earnings.

Earnings at Referral

Perhaps the most important variables for our analysis, save

for a measure of the disabling condition, are the client earnings upon referral to the program and after closure from the program. Unfortunately, current data collection methods do not give meaningful values for these variables. The earnings figures at referral and closure, if reported, are given only for the week prior to applying for services and 60 days after termination of services. These figures are usually not indicative of either true prior or post VR earnings. (For a fuller discussion see Chapters 8 and 9.)

In any event, less than 13% of the sample reported positive earnings at the time of referral to the VR program. Of those with positive earnings, average earnings were $155 per week. Note that only 1.7% of the still-active sub-sample reported positive earnings at referral. This was not surprising given the prevalence of students in this cohort, who have little or no employment history. Moreover, every one of these clients earned less than $100 per week at referral, with an average of $54. This differs substantially from the successful and non-successful cohorts, in which 20% and 12%, respectively, reported positive earnings. The average reported weekly earnings at referral for both groups were more than $150 and are not statistically significantly different. Of course, the reported earnings for the rehabilitated and still-active cohorts differ dramatically.

It was found that over 5% of the Status 26 cohort reported earnings of greater than $200 at referral. Since these clients

already had relatively gainful employment at the time of entry to the program, one would expect a service pattern of relatively short duration, consisting of mainly restorative services. After receipt of the service the client would return to, or continue at, the same place of employment with the same earnings as reported at referral.

Earnings at Closure

The earnings at closure data must be interpreted cautiously. As shown in Chapter 9, an earnings figure 60 days after program termination may not be representative of the client's "permanent" earnings capabilities. Furthermore, the cohort not rehabilitated may report earnings at a later date, some of which may be attributable to the impact of the VR services received. To consider these clients "unsuccessfully" rehabilitated severely underestimates the efficacy of the services rendered.

The magnitude of this problem can now be put in context. Almost 55% (910 clients) of the sample reported either zero earnings or did not report earnings at closure. Of these 910, 890 were either in active status or closed unsuccessfully, thus by definition, having no earnings at closure. By implication, there were 20 clients in the sample who were closed successfully to homemaker status, and therefore suitably employed, but reported zero earnings.

Of those reporting positive earnings at closure, the average

was $160. Just under one-quarter of these reported earning less than $100. The majority of the positive wage earners (51.2%) reported earnings between $100 and $200. Finally, just over one-quarter reported earnings at closure above $200 per week.

Service Variables

Thirty-nine different types of services were provided by the Wisconsin VR Agency. Those can be aggregated into five major categories: diagnostic, education, training, restorative, and others (which includes maintenance, transportation and other miscellaneous services). The percentage of clients receiving a particular service and its average dollar value are presented in Table 13-3 below.

TABLE 13-3 SERVICES

TESTS OF THE DIFFERENCES IN MEAN VALUES FOR SERVICES RECEIVED
AMONG THE THREE COHORTS: SUCCESSES, NON-SUCCESSES AND STILL ACTIVES
(FROM A SAMPLE OF 1,670 CLIENTS OF THE WISCONSIN DRS)

TYPE OF SERVICE RECEIVED	MEAN VALUES FOR THE FULL SAMPLE (N = 1670)	MEAN VALUES FOR SUCCESSES (N = 782)	MEAN VALUES FOR NON-SUCCESSES (N = 364)	T-STATISTICS FOR THE TEST OF DIFFERENCES IN THE MEAN	MEAN VALUES FOR STILL ACTIVES (N = 524)	T-STATISTICS FOR THE TEST OF DIFFERENCES IN THE MEAN
DIAGNOSTIC:						
% RECEIVING	85.1	84.7	82.7	0.83	87.4	1.42
$ AMOUNT RECVD., IF ANY	248.97	272.7	261.27	1.98 *	278.	3.11 *
EDUCATIONAL:						
% RECEIVING	25.8	15.2	7.0	3.78 *	54.0	15.33 *
$ AMOUNT RECVD IF ANY	1083.38	654.75	264.22	4.94 *	1347	6.96 *
RESTORATIVE:						
% RECEIVING	10.2	11.5	3.3	5.56 *	13.2	0.89
$ AMOUNT RECVD., IF ANY	432.5[illegible]	468.46	322.83	4.07 *	439.	0.27
TRAINING:						
% RECEIVING	19.1	20.2	13.5	2.94 *	21.3	0.51
$ AMOUNT RECVD., IF ANY	957.55	926.48	79[illegible] 20	1.23	1074	1.30
MAINT.,TRANSPORT & OTHER:						
% RECEIVING	[illegible]	45.3	29.9	5.12 *	55.5	3.65 *
$ AMOUNT RECVD., IF ANY	818.48	763.98	341.63	6.10 *	1063	3.16 *
TOTAL SERVICES	1170.83*	875.13	449.96	7.18 *	1849	10.38 *

* Denotes difference at the 5% level of significance between the successful cohort and the non-successful and the still active cohorts respectively

TABLE 13-4

TESTS OF THE DIFFERENCES IN MEAN VALUES FOR IMPAIRMENT PREVALENCE AMONG THE THREE COHORTS: SUCCESSES, NON-SUCCESSES AND STILL ACTIVES (FROM A SAMPLE OF 1,670 CLIENTS OF THE WISCONSIN DRS)

TYPE OF IMPAIRMENT	MEAN VALUES FOR THE FULL SAMPLE (N = 1670)	MEAN VALUES FOR SUCCESSES (N = 782)	MEAN VALUES FOR NON-SUCCESSES (N = 364)	T-STATISTICS FOR THE TEST OF DIFFERENCES IN THE MEAN	MEAN VALUES FOR STILL ACTIVES (N = 524)	T-STATISTICS FOR THE TEST OF DIFFERENCES IN THE MEAN
VISUAL (% IMPAIRED)	4.4	4.9	2.7	1.83	4.8	0.07
HEARING (% IMPAIRED)	4.6	5.6	1.4	4.14 *	5.2	0.37
ORTHOPEDIC (% IMPAIRED)	27.7	25.6	26.4	0.29	31.7	2.38 *
AMPUTATION (% IMPAIRED)	2.2	2.6	0.8	2.35 *	2.5	0.08
MENTAL (% IMPAIRED)	47.1	48.1	56.3	2.61 *	39.1	3.22 *
INTERNAL (% IMPAIRED)	14.1	13.3	12.4	0.44	16.4	1.54

* Denotes difference at the 5% level of significance between the successful cohort and the non-successful and the still active cohorts respectively

In our sample, 47% were classified as mentally impaired. Just under 28% were orthopedically impaired and 14% were classified as having other impairments. The remaining three classifications accounted for only about 11% of the sample.

When the condition classifications are examined across closure status, some dramatic differences emerge. The stratification by disability classification for the successful cohort and the overall sample are remarkably similar. This implies then that this cohort must differ from both the non-successes as well as those still receiving services. Indeed, we find significant differences in several impairment groupings.

First, it should be noted that the non-successes have significantly lower representation in the sensory disabilities - vision and hearing - as well as in the amputation classification. Of course these are the very classifications that make up only one-ninth of the disability classifications for the entire sample. The clear implication is that while these disabling conditions do not comprise a large component of the VR caseload, if a client with such an impairment is accepted for services, there is a much better prospect for a "successful" outcome than for the other conditions.

Given the low proportion of physical impairments, it is not surprising to see the non-successes over-represented in the

mental and emotional disability categories. While less than half of the success cohort was diagnosed with such an impairment, over 56% of the clients not rehabilitated were reported as having some form of mental impairment. The two cohorts did not differ with respect to either the proportion of the loosely-defined orthopedic or internal impairment classifications.

The success and still-active cohorts differed in the prevalence of other disabling conditions. Most noticeable is that less than 40% of those still receiving services were diagnosed with some mental or emotional condition. Furthermore, while only one-fourth of the rehabilitated group had an orthopedic impairment, almost one-third of the still-actives were diagnosed with such a condition. This cohort also had a 3% higher proportion of clients with an internal impairment, although this difference was not significant.

On the whole, it can be seen that the still-active group is over-represented in the physical impairment category as opposed to the mental or sensory classification. An inference can be drawn that these clients have low levels of education and a relatively mild physical disability which makes them eligible for such a regime. Of course with only the condition classification, it is impossible to glean much useful information about the severity of the disabling condition. For this, one requires some form of health/functioning measure, which the Wisconsin data set provides us with in the Functional Assessment Inventory.

C. Functional Assessment Inventory Results

The FAI consists, in part, of thirty questions that attemt to assess physical, mental and emotional limitations. There are also some questions that address the client's vocational capabilities. The instrument was administered by the client's VR counselor. For each question the client receives a score of zero to three, indicating no impairment, mild impairment, moderate impairment or severe impairment.

For some of the categories, the scoring requires little rater judgement, while in others rater discretion is important. For example, the vision variable relies largely on an eye examination, with different acuity levels assigned to FAI scores. On the other hand, the variable titled "effective interaction with people" requires the rater to distinguish, for example, mild impairment ("Is somewhat awkward or unpleasant in social interactions") from moderate impairment ("Lacks many of the skills necessary for effective interaction"). In spite of the demand on counselor discretion, evidence has shown the FAI to exhibit a high degree of inter-rater reliability. (Abt Associates).

In examining the results of the FAI, it is necessary to look at three different aspects. First the question of whether or not a client has a particular impairment will be addressed. It may be that the mere presence of an impairment has a significant

impact on eventual client outcome. The prevalence of the various impairments can be found in Table 13-5.

The next issue is then to determine the severity of the impairment for those clients with a given limitation. This measure can be reported in two different ways. The percentage of the entire sample with a given degree of severity for each FAI item is reported in Table 13-5. The percentage of clients with a particular degree of impairment severity, if they report some impairment at all, is then reported in Table 13-6.

In addition to looking at the functional limitations for the full sample, it is important to examine any differences that may arise within the three cohorts that we have established. Since we have constructed our health/functioning index using the entire sample, any correlation between impairment and closure status will be worth noting. It may be that there are different prevalence rates for the 30 FAI categories among the three cohorts. These prevalences and a significance test of the differences in these rates are reported in Table 13-7 It may turn out that the same percent of clients in each group have a specific impairment, but the severity of the limitation will differ. This difference in the severity of the impairment for the various cohorts will be examined in Table 13-8.

Let's first look at the impairment prevalence for the full sample as reported in Table 13-5. In six of the thirty categories

TABLE 13-5

FUNCTIONAL ASSESSMENT INVENTORY RESULTS
FROM 1670 CLIENTS OF THE WISCONSIN
DIVISION OF REHABILITATIVE SERVICES

NUMBER & PERCENTAGE OF CLIENTS WITH NONE, MILD, MODERATE & SEVERE IMPAIRMENT

FAI VARIABLE	IMPAIRED: NONE	PERCENT OF TOTAL	IMPAIRED: MILD	PERCENT OF TOTAL	IMPAIRED: MODERATE	PERCENT OF TOTAL	IMPAIRED: SEVERE	PERCENT OF TOTAL	MEAN VALUE	STANDARD DEVIATION
VISION	1516	90.8	86	5.2	44	2.6	23	1.4	0.15	0.55
HEARING	1567	93.9	57	3.4	23	1.4	22	1.3	0.11	0.49
AMBULATION·MOBILITY	1197	71.8	345	20.7	92	5.5	34	2.0	[illegible]	0.73
UPPER EXTREMITY FUNCTIONING	1454	87.1	139	8.3	70	4.2	6	0.4	0.19	0.54
HAND FUNCTIONING	1424	85.3	187	11.2	47	2.8	12	0.7	0.19	0.50
COORDINATION	1370	82.0	237	14.2	55	3.3	8	0.5	0.22	0.52
MOTOR SPEED	1217	72.9	340	20.4	101	6.0	12	0.7	0.35	0.63
CAPACITY FOR EXERTION	868	52.1	499	30.0	263	15.8	35	2.2	[illegible]	0.89
ENDURANCE	1152	69.1	375	22.5	102	6.1	39	2.3	0.43	0.76
LOSS OF TIME FROM WORK	1218	72.9	359	21.5	43	2.6	52	[illegible]	[illegible]	0.68
STABILITY OF CONDITION	635	38.0	699	41.9	318	19.0	[illegible]	[illegible]	[illegible]	0.77
LEARNING ABILITY	1134	67.9	260	15.6	191	11.4	[illegible]	[illegible]	[illegible]	0.90
PERCEPTUAL ORGANIZATION	1359	81.4	263	15.7	43	[illegible]	[illegible]	[illegible]	[illegible]	0.49
MEMORY	1377	82.5	229	13.7	60	[illegible]	[illegible]	[illegible]	[illegible]	0.51
LANGUAGE FUNCTIONING	1467	87.9	151	9.0	35	2.1	[illegible]	[illegible]	[illegible]	0.52
LITERACY	1278	76.5	231	13.8	121	[illegible]	[illegible]	[illegible]	[illegible]	0.72
SPEECH	1475	88.4	140	8.4	32	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
JUDGMENT	976	58.4	539	32.3	130	7.3	[illegible]	[illegible]	[illegible]	[illegible]
PERSISTENCE	1142	68.4	418	25.0	88	5.3	[illegible]	[illegible]	[illegible]	[illegible]
CONGRUENCE OF BEHAVIOR WITH REHAB GLS	1193	71.4	364	21.8	78	4.7	[illegible]	[illegible]	[illegible]	[illegible]
ACCURATE PERCEPTION OF CAPAB/LIMIT	1037	62.1	506	30.3	109	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
EFFECTIVE INTERACTION WITH PEOPLE	1090	65.3	397	23.8	143	8.6	[illegible]	[illegible]	[illegible]	0.77
SOCIAL SUPPORT SYSTEM	1153	69.1	412	24.7	89	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PERSONAL ATTRACTIVENESS	1388	83.2	254	15.2	21	1.3	[illegible]	[illegible]	[illegible]	0.49
SKILLS	617	36.9	667	39.9	281	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WORK HABITS	1141	68.4	362	21.7	146	8.7	[illegible]	[illegible]	[illegible]	0.73
WORK HISTORY	614	36.8	727	43.6	262	[illegible]	[illegible]	[illegible]	[illegible]	0.83
ACCEPTABILITY TO EMPLOYERS	621	37.2	746	44.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.85
ACCESS TO JOB OPPORTUNITIES	834	50.1	613	36.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ECONOMIC DISINCENTIVES	1360	81.6	223	13.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

over 85% of the clients had no impairment. These categories include hearing and vision, speech, language functioning, u er extremity functioning and hand functioning. For vision and hearing less than ten percent of the sample were reported to have any impairment at all. One possible explanation for the small number of clients with impairments within these largely physical or sensory functioning categories is that the client is assessed while "utilizing whatever adaptive equipment may be available to him," such as eyeglasses, hearing aids, wheelchairs, or prostheses. It is also possible that the presence of these functional limitations do not make a client a suitable candidate for rehabilitation in Wisconsin. For instance, a blind client may be referred to an agency outside the purview of VR.

At the other end of the prevalence spectrum, in nine of the FAI categories more than one-third of the clients in the sample have some degree of impairment. These include mainly variables that assess emotional and vocational aspects of a client's functioning. Specifically, skills, work history, acceptability to employers and stability of condition were areas of functioning where more than 60% of all clients sampled were assessed as having some impairment. Between thirty and fifty percent of all clients were assessed to have some impairment in the areas of economic disincentives, capacity for exertion, accurate perception of capabilities and effective interaction with people.

TABLE 13-6

FUNCTIONAL ASSESSMENT INVENTORY RESULTS
FROM 1670 CLIENTS OF THE WISCONSIN
DIVISION OF REHABILITATIVE SERVICES

DEGREE OF SEVERITY OF IMPAIRMENT

FAI VARIABLE	NUMBER WITH SOME IMPAIRMENT	PERCENT OF ALL CLIENTS WITH SOME IMPAIRMENT (N = 1670)	IF IMPAIRED: PERCENT MILD	IF IMPAIRED: PERCENT MODERATE	IF IMPAIRED: PERCENT SEVERE
VISION	153	9.2%	56.2%	28.8%	15.0%
HEARING	102	6.1%	55.9%	22.5%	21.6%
AMBULATION-MOBILITY	471	28.2%	73.2%	19.5%	7.2%
UPPER EXTREMITY FUNCTIONING	215	12.9%	64.7%	32.6%	2.8%
HAND FUNCTIONING	246	14.7%	76.0%	19.1%	4.9%
COORDINATION	300	18.0%	79.0%	18.3%	2.7%
MOTOR SPEED	453	27.1%	75.1%	22.3%	2.6%
CAPACITY FOR EXERTION	798	47.9%	62.5%	33.0%	4.5%
ENDURANCE	516	30.9%	72.7%	19.8%	7.6%
LOSS OF TIME FROM WORK	452	27.1%	79.4%	9.5%	11.1%
STABILITY OF CONDITION	1035	62.0%	67.5%	30.7%	1.7%
LEARNING ABILITY	535	32.1%	48.6%	35.7%	15.7%
PERCEPTUAL ORGANIZATION	311	18.6%	84.6%	13.8%	1.6%
MEMORY	293	17.5%	78.2%	20.5%	1.4%
LANGUAGE FUNCTIONING	202	12.1%	74.8%	17.3%	7.9%
LITERACY	392	23.5%	58.9%	30.9%	10.2%
SPEECH	193	11.6%	72.5%	16.6%	10.9%
JUDGMENT	694	41.6%	77.7%	18.7%	3.6%
PERSISTENCE	528	31.6%	79.2%	16.7%	4.2%
CONGRUENCE OF BEHAVIOR WITH REHAB GLS	477	28.6%	76.3%	16.4%	7.3%
ACCURATE PERCEPTION OF CAPAB/LIMIT	633	37.9%	79.9%	17.1%	3.0%
EFFECTIVE INTERACTION WITH PEOPLE	579	34.7%	68.6%	24.7%	6.7%
SOCIAL SUPPORT SYSTEM	515	30.9%	80.0%	17.3%	2.7%
PERSONAL ATTRACTIVENESS	281	16.8%	90.4%	7.5%	2.1%
SKILLS	1053	63.1%	63.3%	26.7%	10.0%
WORK HABITS	528	31.6%	68.6%	27.7%	3.8%
WORK HISTORY	1055	63.2%	68.9%	24.8%	6.3%
ACCEPTABILITY TO EMPLOYERS	1047	62.5%	71.3%	[illegible]	6.0%
ACCESS TO JOB OPPORTUNITIES	830	[illegible]	73.9%	19.6%	6.5%
ECONOMIC DISINCENTIVES	307	[illegible]	[illegible]	[illegible]	7.8%

From Table 13-6 we gain a different perspective. A closer look reveals that regardless of the prevalance of impairment, the degree of severity is generally mild. For 29 of the 30 functioning categories, of those impaired, more than 50% were assessed to have a mild degree of impairment. Only for those clients with a learning ability dysfunction were more than half impaired moderately or severely. Moreover, for 28 of the 30 functioning categories, the percentage of those <u>mildly</u> impaired exceeded the percent of those <u>moderately</u> impaired, which in turn exceeded the percent of those <u>severely</u> impaired. Thus, the relative prevalence of severe impairment was low. For only seven of the categories was severe impairment assessed for more than 10% of the clients with some impairment; only hearing exceeded 20% (21.6%).

Interestingly, the categories with a lower <u>percentage</u> of clients having some impairment had a slightly higher <u>degree</u> of severity of impairment. Again, these are the sensory or physical functioning areas, e.g., hearing, vision and upper extremity functioning. This indicates possibly that more severe impairment in sensory functioning is required than for mental and emotional limitations to be eligible for VR. For the six attributes in which over 85% of the sample had no impairment, of those impaired 56-76% had mild impairment. Meanwhile, for the nine attributes in which more than one-third of the sample were reported to have

some impairment, the percentage of mild impairment ranged from 63-80%.

Some very interesting differences arise when the sample is decomposed into the three closure status cohorts and examined with respect to the FAI. Two different measures are examined within these cohorts. First, any differences in the prevalence of an impairment across cohorts were investigated. A test was then performed which looked for significant differences in the average severity of an impairment across the three cohorts.

For instance, from Table 13-7 it can be seen that the full sample prevalence of visual impairment is 9.2%. This was comprised of the successfully rehabilitated cohort, in which 9.7% of the clients were reported to have a visual impairment, and the non-success and still active groups, which averaged 9.3 and 8.4% respectively. From the reported T-statistics it can be seen that there is not a significant difference in the <u>prevalence</u> of blindness <u>between</u> the success cohort and the other two.

However, there is a difference between the groups with regard to the <u>severity</u> of the visual impairment. From Table 13-8 it is seen that the average severity of blindness for the entire sample is 1.63. This represents a degree of impairment gauged to be closer to "moderate" than "mild" by the counselors for the sample. Thus, for the rehabilitated cohort the average degree of severity of 1.50 indicates a level of impairment mid-way between mild and moderate. This degree of impairment is not

significantly milder than the average score of 1.59 that was recorded for the non-success cohort. It is significantly less severe than the 1.89 average recorded by those clients still receiving services who were reported with some level of visual impairment. This implies that the more severely visually impaired clients require similar services that are of longer duration than the already-rehabilitated clients or that they receive a different

service mix altogether.

There are numerous differences among the three cohorts when compared via these prevalence and degree of severity measures. Let's first concentrate on the differences between the successful and non-successful cohorts. First, observe that there are 16 FAI categories in which the rates of impairment prevalence differ significantly in the statistical sense. In 15 of these items the non-successes had a significantly <u>higher</u> prevalence rate. All of these items are concentrated in either the emotional, mental or vocational functioning categories. The sole category that the non-successes had a significantly lower prevalence rate was in the hearing category.

For six categories not only was the prevalence rate higher but there was also a greater degree of severity when the clients were reported to have the impairment. These FAI items included emotional categories such as judgment and social interaction and

TABLE 13-7

FUNCTIONAL ASSESSMENT INVENTORY RESULTS FROM 1,670 CLIENTS
OF THE WISCONSIN DIVISION OF REHABILITATIVE SERVICES

TESTS OF THE DIFFERENCE IN THE PERCENTAGE OF PREVALENCE OF AN IMPAIRMENT
AMONG THE THREE COHORTS: SUCCESSES, NON SUCCESSES AND STILL ACTIVES

FAI VARIABLE	NUMBER OF IMPAIRED CLIENTS IN VR SAMPLE	% OF ALL VR CLIENTS IMPAIRED (N = 1,670)	NUMBER OF SUCCESSES IMPAIRED	% OF ALL SUCCESSES IMPAIRED (N = 782)	NUMBER OF NON-SUCCESSES IMPAIRED	% OF ALL NON-SUCCESSES IMPAIRED (N = 364)	T-STATISTICS FOR THE TEST OF DIFFERENCES IN THE MEANS	NUMBER OF STILL ACTIVES IMPAIRED	% OF ALL STILL ACTIVES IMPAIRED (N = 524)	T STATISTICS FOR THE TEST OF DIFFERENCES IN THE MEANS
VISION	153	[illegible]	76	9.7	34	9.3	0.20	44	8 4	0.81
HEARING	102	[illegible]	56	7.2	12	3.3	2.58 *	35	6.7	0 33
AMBULATION MOBILITY	471	28.[illegible]	205	26	94	25.8	0.14	174	33 2	2 70 *
UPPER EXTREMITY FUNCTIONING	215	12.9	105	13.[illegible]	43	11 8	0.76	68	13 0	0 24
HAND FUNCTIONING	246	14.7	114	14.6	47	12.9	0.76	85	15 2	0 80
COORDINATION	300	18.0	139	17.8	59	16.2	0.65	102	19 5	0 77
MOTOR SPEED	453	27.1	198	25.3	101	27.7	0 86	154	[illegible]	[illegible] 61
CAPACITY FOR EXERTION	798	48.[illegible]	350	44.8	169	46.4	0 53	283	54 0	3 29 *
ENDURANCE	516	81.0	221	28.3	118	32.4	1 41	[illegible]	34 [illegible]	[illegible] 25 *
LOSS OF TIME FROM WORK	452	27.1	192	24.6	109	29.9	1 89	151	28 8	[illegible] 70
STABILITY OF CONDITION	1035	62.0	470	60.1	237	65.1	1 [illegible]	[illegible]	[illegible]	0 91
LEARNING ABILITY	535	32.1	246	31 5	136	37 4	1 95 *	[illegible]	[illegible]	[illegible] 79
PERCEPTUAL ORGANIZATION	311	18.6	140	17.9	85	23 4	2 [illegible] *	86	16 [illegible]	0 70
MEMORY	293	17 5	136	17 4	77	21 2	1 48	[illegible]	[illegible]	[illegible] 01
LANGUAGE FUNCTIONING	202	12.1	101	12.9	38	10 4	1 [illegible]	[illegible]	[illegible]	[illegible] 37
LITERACY	392	23.5	178	22.8	108	29 7	2 44 *	174	22 2	[illegible] 09
SPEECH	193	11.7	91	11 6	39	10 7	0 46	[illegible]	[illegible]	[illegible] 42
JUDGMENT	694	41 6	314	40 2	118	54 4	4 52 *	[illegible]	[illegible]	[illegible] 98 *
PERSISTENCE	528	31 6	226	28.9	160	44 0	4 91 *	[illegible]	[illegible]	[illegible]
CONGRUENCE OF BEHAVIOR WITH REHAB OBJS	477	28 6	202	25.8	144	39 6	4 57 *	[illegible]	[illegible]	[illegible]
ACCURATE PERCEPTION OF CAPABILITY	633	37.9	281	35 9	171	47 0	3 5[illegible] *	[illegible]	[illegible]	[illegible]
EFFECTIVE INTERACTION WITH PEOPLE	579	34 7	262	33 5	156	42 9	[illegible] *	[illegible]	[illegible]	[illegible] 2
SOCIAL SUPPORT SYSTEM	515	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] *	[illegible]	[illegible]	[illegible]
PERSONAL ATTRACTIVENESS	281	16.9	122	15 6	75	20 [illegible]	2 11 *	[illegible]	[illegible]	[illegible] *
SKILLS	1053	63 1	437	55.9	254	69 8	4 51 *	[illegible]	[illegible]	[illegible]
WORK HABITS	528	31.7	220	28 1	164	45.[illegible]	5 [illegible] *	[illegible]	[illegible]	[illegible] *
WORK HISTORY	1055	63 2	428	54 7	270	74.[illegible]	[illegible] *	[illegible]	[illegible]	0 18
ACCEPTABILITY TO EMPLOYERS	1047	62.8	461	59 0	264	72 5	4 [illegible] *	[illegible]	[illegible]	4 75 *
ACCESS TO JOB OPPORTUNITIES	830	[illegible]0 1	374	47.9	198	54 4	2 [illegible] *	[illegible]	[illegible]	[illegible]
ECONOMIC DISINCENTIVES	307	18 6	134	17.1	80	22 0	[illegible]	[illegible]	[illegible]	[illegible] 55

* DENOTES DIFFERENCE AT THE 5% LEVEL OF SIGNIFICANCE
BETWEEN THE SUCCESSFUL COHORT AND THE NON SUCCESSFUL
AND THE STILL ACTIVE COHORT RESPECTIVELY

TABLE 13-8

FUNCTIONAL ASSESSMENT INVENTORY RESULTS
FROM 1670 CLIENTS OF THE WISCONSIN
DIVISION OF REHABILITATIVE SERVICES

TESTS OF THE DIFFERENCE IN MEAN VALUES FOR THE SEVERITY OF IMPAIRMENT
AMONG THE THREE COHORTS: SUCCESSES, NON-SUCCESSES AND STILL ACTIVES,
FOR ONLY THOSE CLIENTS WITH AN IMPAIRMENT IN THAT FUNCTIONING CATEGORY

FAI VARIABLE	NUMBER OF IMPAIRED CLIENTS IN VR SAMPLE (N = 1670)	MEAN FAI SCORES FOR IMPAIRED VR CLIENTS	NUMBER OF SUCCESSES IMPAIRED	MEAN FAI SCORES FOR IMPAIRED SUCCESSES	NUMBER OF NON-SUCCESSES IMPAIRED	MEAN FAI SCORES FOR IMPAIRED NON SUCCESSES	T-STATISTICS FOR THE TEST OF DIFFERENCES IN THE MEANS	NUMBER OF STILL ACTIVES IMPAIRED	MEAN FAI SCORES FOR IMPAIRED STILL ACTIVES	T-STATISTICS FOR THE TEST OF DIFFERENCES IN THE MEANS
VISION	153	1.63	76	1.50	34	1 59	0 58	44	[illegible]	2 22 *
HEARING	102	1.72	56	1.68	12	1.25	2 01 *	35	1 [illegible]	1 17
AMBULATION MOBILITY	471	1.37	205	1.32	94	1 31	0 17	[illegible]	[illegible]	1 64
UPPER EXTREMITY FUNCTIONING	215	1.41	105	1.31	43	1.51	1 72	[illegible]	[illegible]	1 73
HAND FUNCTIONING	246	1.29	114	1.20	47	1.32	1 45	[illegible]	1 29	2 39 *
COORDINATION	300	1.24	139	1.17	59	1.20	0 [illegible]	[illegible]	1 3[illegible]	2 68 *
MOTOR SPEED	453	1.28	198	1.20	101	0.13	1 17	[illegible]	1 39	3 20 *
CAPACITY FOR EXERTION	798	1.45	350	1.43	169	0.15	0.47	283	1.48	0.96
ENDURANCE	516	1.37	221	1.34	118	1.48	1 62	179	1 35	0 11
LOSS OF TIME FROM WORK	452	1.32	192	1.26	109	1.31	0.78	[illegible]	1 40	1.97 *
STABILITY OF CONDITION	1035	1.34	470	1.32	237	1.37	1 29	328	1 35	0 95
LEARNING ABILITY	535	1.68	246	1.67	136	1 77	1.17	[illegible]	1 6[illegible]	0 64
PERCEPTUAL ORGANIZATION	311	1.17	140	1 14	85	1.18	0 61	[illegible]	[illegible]	1 19
MEMORY	293	1.23	136	1.24	77	1.19	0 76	[illegible]	[illegible]	0 12
LANGUAGE FUNCTIONING	202	1.36	101	1.33	38	1 29	0 75	[illegible]	[illegible]	1 38
LITERACY	392	1.51	178	1.50	108	1 58	1 [illegible]	[illegible]	[illegible]	0 46
SPEECH	193	1.45	91	1 45	79	1 31	1 08	[illegible]	1 54	0 53
JUDGMENT	694	1.26	314	1 23	198	1.32	2 07 *	[illegible]	[illegible]	[illegible]
PERSISTENCE	528	1.25	226	1.19	160	1.23	1 63	[illegible]	[illegible]	[illegible] *
CONGRUENCE OF BEHAVIOR WITH REHAB GLS	477	1.31	202	1.25	144	1 37	1 80	[illegible]	[illegible]	[illegible]
ACCURATE PERCEPTION OF CAPAB/LIMIT	633	1.23	281	1.24	171	1 25	0 15	[illegible]	[illegible]	[illegible]
EFFECTIVE INTERACTION WITH PEOPLE	579	1.39	262	1.31	156	1 47	2 8[illegible] *	[illegible]	[illegible]	[illegible] *
SOCIAL SUPPORT SYSTEM	515	1.25	245	1 20	146	1.31	1 9[illegible]	[illegible]	[illegible]	[illegible]
PERSONAL ATTRACTIVENESS	281	1.14	122	1 16	76	1 12	0 45	[illegible]	[illegible]	[illegible]
SKILLS	1053	1 47	[illegible]	[illegible]	[illegible]	[illegible]	3 4[illegible] *	[illegible]	[illegible]	[illegible] *
WORK HABITS	528	1.36	220	1.31	174	1 45	2 [illegible] *	[illegible]	[illegible]	[illegible]
WORK HISTORY	1055	1.38	428	1 34	270	1.57	4 41 *	[illegible]	[illegible]	[illegible]
ACCEPTABILITY TO EMPLOYERS	1047	1.37	461	1.30	264	1 48	3 [illegible] *	[illegible]	[illegible]	[illegible]
ACCESS TO JOB OPPORTUNITIES	830	1.37	374	1 38	198	1 36	0 21	[illegible]	[illegible]	[illegible]
ECONOMIC DISINCENTIVES	307	1.42	134	1.30	80	1 50	1 72	[illegible]	[illegible]	[illegible]

a THE SCORING VALUES FOR THE FAI IMPAIRMENTS RANGE FROM [illegible]
WHERE A "0" CORRESPONDS TO NO IMPAIRMENT AND A "3"
REPRESENTS A SEVERE FUNCTIONAL IMPAIRMENT

* DENOTES DIFFERENCE AT THE 5% LEVEL OF SIGNIFICANCE
BETWEEN THE SUCCESSFUL COHORT AND THE NON SUCCESSFUL
AND THE STILL ACTIVE COHORTS RESPECTIVELY

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and acceptability to employers.

Interestingly enough, the only category where the non-successes had a significantly <u>lower</u> degree of impairment was in the hearing item. This higher prevalence and degree of hearing impairment for the successfully rehabilitated cohort viz-a-viz the not-rehabilitated cohort is indicative of two things. First, VR has historically had very good success in placing the hearing impaired in competitive employment. One would thus expect a lower rate of "failures" for this category. The fact that those not successfully rehabilitated had a lesser degree of impairment may indicate that the hearing impairment was not the primary reason for acceptance into the program, but rather was ancillary to some more serious dysfunction.

The differences between the successes and those clients still receiving services are not quite as dramatic but still support our contention that there are three dichotomous groups receiving rehabilitation services. First, observe that there are seven FAI categories in which the prevalence rates between the two cohorts differ significantly. The still-active group is more likely to be impaired in those physical and vocational functioning categories - mobility, exertion, endurance and work history and skills - that require a lengthy regimen of work-hardening. On the other hand they are <u>less</u> likely to have judgment or social support difficulties. This might explain the

tendency of this group to stay with a prescribed rehabilitation program for a longer period.

There are seven FAI categories in which there are statistically significant differences between these two cohorts with respect to severity of disability. In each case the group still receiving services was more severely impaired than the rehabilitated cohort. In addition to the aforementioned visual impairment, those still receiving services tended to be more severely impaired in those functioning categories that indicate a need for work-hardening, or re-training. These categories consist of hand-functioning, coordination, motor speed, persistence and skills. Other areas in which the two groups differed were interaction with other people and loss of work time.

We have found that there are significant differences among the cohorts that make up the full sample. This is important because although we created the health variable using the full sample, we have estimated the earnings equation using only those who have positive earnings at program completion. Because of this difference, we must be careful not to apply the results of the empirical analysis in the next section to those VR clients who are not successfully rehabilitated.

III. Specification of the health variable for the earnings equation.

A. No health variable.

The result of preliminary estimation using an earnings equation without controlling for health (model 1, table 13-9) gave rise to the expected sign on demographic and socio-economic variables, but unexpected (and significant) signs for training and education services. There are three impacts due to omitted variable bias. First, we can't be confident of the sign or magnitudes of the parameter estimates. For instance, some of the estimates may be inordinately high, if omitted variables are collinear (nonorthogonal) with included variables. In this case the model attributes too much explanatory power to the included variables. Second, if the omitted variable is orthogonal to included explanatory variables, then the residual error term is not random, violating an assumption of the model, and the resulting standard errors for the remaining independent variables will be higher. Concomittantly, the explanatory power of the model as a whole will be reduced, evidenced by a lower R^2. The R^2 in model 1 is .23, low even for a standard earnings equation.

Most importantly, by excluding a measure of health in estimating the impact of services on earnings, one fails to distinguish among clients of different severity of disability. Equal amounts of treatment for individuals identical except for

TABLE 13-9

EARNINGS EQUATION ESTIMATION USING TWO DIFFERENT HEALTH VARIABLES

DEPENDENT VARIABLE - LOG EARNINGS AT CLOSURE	MODEL 1 NO HEALTH VARIABLE		MODEL 2 RSA HEALTH VARIABLE		MODEL 3 FAI HEALTH VARIABLE	
VARIABLE	PARAMETER ESTIMATE	T-RATIO	PARAMETER ESTIMATE	T-RATIO	PARAMETER ESTIMATE	T-RATIO
INTERCEPT	3.6085 **	14.6	3.557 **	13.9	3.5516 **	14.3
SEXM (MALE=1)	0.3267 **	6.1	0.3329 **	6.2	0.3295 **	6.5
RACEW (WHITE=1)	0.0099	0.1	-0.002	0.0	-0.0447	0.4
AGEREF (AGE AT REFERRAL)	0.[illegible]64 **	5.3	0.0613 **	5.0	0.0628 **	5.4
AGEREF2 (AGE SQUARED)	-0.0001 **	6.0	-0.0002 **	5.8	-0.0009 **	5.9
EDYRS (YEARS OF EDUCATION)	0.0198 *	2.1	0.0206 *	2.2	0.0241 *	2.1
LURNACCP (LOG EARNINGS ACCEPT)	0.0462 **	3.6	0.0457 **	3.5	0.0266 *	2.1
TRAIN ($ TRAINING SERVICES)	-0.0004 **	7.[illegible]	-0.0003 **	6.8	-0.0002 **	5.1
EDUC ($ EDUCATION SERVICES)	0.0002 **	3.5	0.0003 **	3.6	0.0002 **	2.9
RESTOR ($ RESTORATIVE SERVICES)	0.0001	1.1	0.0000	0.2	0.0001	0.9
RSA IMPAIRMENT CATEGORIES ^						
VISUAL (IMPAIRED=1)			-0.0793	0.6		
HEARING (IMPAIRED=1)			0.2862 *	2.2		
ORTHOP (IMPAIRED=1)			0.1658 *	1.9		
AMPUTE (IMPAIRED=1)			0.4982 **	2.7		
MENTAL (IMPAIRED=1)			0.0734	0.9		
FAI HEALTH VARIABLES						
JUDGMENT (FACTOR 1)					-0.0580 *	2.1
MOTOR FUNCTION (FACTOR 2)					-0.0766 **	2.7
COGNITION (FACTOR 3)					-0.0885 **	3.2
PHYSICAL CONDITION (FACTOR 4)					-0.1792 **	6.1
COMMUNICATION (FACTOR 5)					0.0184	0.7
VOCATIONAL QUAL. (FACTOR 6)					-0.2142 **	[illegible]
VISION (FACTOR 7)					-0.0573 *	[illegible]
SAMPLE SIZE	710		710		710	
R-SQUARED	0.23		0.25		0.35	

* DENOTES SIGNIFICANCE AT 5% LEVEL
** DENOTES SIGNIFICANCE AT 1% LEVEL
^ THE REFERENCE CATEGORY IS INTERNAL IMPAIRMENTS

assessed level of functioning would be expected to result in very different earnings impacts. Conversely, to bring about the same enhancement of earning in two persons of different severity of disablility obviously requires different amounts of services. To the extent that levels of severity of disability differ across clients, the omission of a health variable will bias the estimates of the impact of services. In model 1, for every $100 of training services received, earnings are estimated to fall 4%. In the absence of a control for health, these results are not surprising. Specifically, The marginal impact of a dollar of services depends on the level of functioning of the client. The more severely disabled receive greater levels of services . Thus, the omission of a health variable would be expected to have a negative sign.

B. The RSA variable for health.

These problems of omission of a health variable from an earnings or labor supply equation have been recognized in the economics literature in the past decade. But the solution to the problems, that is the appropriate specification of a health variable, is not obvious. Typically, the ideal variable was specified theoretically, but its operationalization left much to be desired. The RSA health construct (model 2, Table 13-9) exemplifies the difficulty of properly constructing a health variable. Probably the most popular representation of health

status is a diagnosis of illness. The RSA health variable described above, is a three digit condition classification cod -- thus a diagnostic classification. This variable was broken down into six categorical variables: visual, hearing, orthopedic, amputee, mental and other internal impairments. using other internal impairments as a basis, we can now interpret the impact of the other five impairment categories on earnings.

The R^2 of the regression was raised slightly from .23 to.25. Secondly, levels of significance did not change for the explanatory variables included in model 1, nor did the signs or magnitudes of the socio-economic and human capital variable parameter estimates. However, there was a 25% increase in the magnitude of the coefficient for training services, albeit the sign was still negative. Also, the parameter estimate for education services increased by 50%.

For the RSA impairment categories, hearing, orthopedic and amputee were all positive and significantly different from the basis group. A positive sign on these variables can be interpreted as measuring the impact of the presence of these impairments versus the basis impairment variable. As explained above, this significance issue depends on the choice of basis variable, and can therefore not be given an absolute interpretation. For example, an amputee will have a 49% higher level of earnings than a person of similar non-health characteristics with other internal impairments. On the other

hand, the presence of visual and mental impairments were not significantly different from the basis in terms of impact on earnings. Clearly, then, this health variable is not a particularly sensitive measure of the impact of health, or functioning, on earnings.

C. Raw FAI scores as health variables.

The FAI scores consist of the thirty scaled responses assessing different aspects of functioning. The simplest use of this information as explanatory variables is to incorporate each of the thirty elements as continuous variables in the earnings equation. This model contains the usual battery of demographic and socio-economic variables as well as the 30 FAI proxies for health.

The results of this estimation are unwieldy, but are in some ways an improvement over model 1. Most of the demographic and socio-economic variables are still significant and of approximately the same magnitude. Of the 30 functional assessment response variables, only hand functioning, coordination, endurance and work history were statistically significant at the 5% level. Of these, three were of the expected negative sign, but coordination, inexplicably, was positive. The coefficients on the functional assessment variables can be interpreted as follows: a one unit fall in the level of, say, hand functioning brings an estimated reduction in

earnings of $27. There is no a priori reason that, for example, work history would be expected to be significant and not work habits or acceptability to employers, both related areas of functioning. In the physical realm, upper extremity functioning and hand functioning are likely to be correlated. However, since these areas are related conceptually, and thus potentially collinear, we would not be surprised to find only one to be significant, with the T-ratios of the others reduced.

This specification of the health variable lends little additional explanatory power to the earnings equation. The R^2 increased to .29 up from .23 in model 1. This is expected from simply having added 30 more explanatory variables to the model. Furthermore, 26 of these 30 are statistically insignificant, some because of the multicollinearity problem mentioned above.

This specification is also unwieldy and of dubious interpretive value, due to the design of the FAI. The FAI was structured to measure functioning of different general categories. But within each category several aspects are assessed. Thus we would expect to be able to capture the impact of health, or functioning, on earnings, in a more aggregative specification. The non-orthogonality of FAI categories indicates that data reduction is possibly appropriate to give a clearer interpretation of the impact of functioning on earnings.

D. Summing the FAI into one index.

The simplest aggregation of the FAI response data is its

summation into a single continuous index, ranging from 0, for absolutely no significant impairments ,to 90, for severely limited in functioning in all the measured categories. This model includes such a specification of the health index as well as the standard socio-economic and demographic variables. The results of the estimation are similar in overall explanatory power of the model, and the sign, magnitude and significance of the parameter estimates to the completely disaggregated model three specification. Not surprisingly, the coefficient on the cumulative functioning variable is negative and significant at the 1% level. The interpretation of this coefficient is that a on unit change in the functioning index is associated with a 2.7% change in earnings at closure.

The problems with this specification of the health variable are numerous. First, as a linear specification, the model implicitly assumes the marginal impact of a one unit change in functioning is constant, i.e. the same at all levels of functioning. For example a person experiencing a decrease in the level of functioning from 10 to 11 is estimated to have his/her earnings impacted the same as a person experiencing a decrease in the level of functioning from 75 to 76. A priori there is no reason to think that either a log-linear specification, where the marginal impact of a one-unit change are increasing, or a sigmoidal representation, where the impacts

increase, reach a threshold, and then decrease, are not equally defensible as specifications for the cumulative index. More importantly, by summing the scores across functioning areas, we implicitly assume each variable has equal contribution to the change in earnings. For instance, the same decrease in level of functioning from 10 to 11 may be the result of a change in different aspects of functioning (e.g. physical, mental, emotional) for different clients, which may have dramatically different impacts on client earnings. While we saw above that including all 30 FAI functioning attributes as explanatory variables was unwieldy and of limited interpretive value, the cumulative specification of a single linear scale masks the differential impact on earnings attributable to equal FAI score changes in different categories of functional capabilities. This gives us reason to believe that some intermediate level of aggregation of the FAI data may be a more appropriate specification of the health variable. Two possible methods of aggregation are principal components analysis and factor analysis.

E. Principal components of FAI scores as health variables.

Instead of working with 30 FAI variables, it is possible to transform these into a much smaller set of variables through a linear transformation. Ideally, we would want linear composites that have high correlations with the original variables and explain a lot of the variation among the FAI variables. This is

equivalent to maximizing the variance of the linear composite, i.e. extracting the most amount of variance possible in a linear combination, and given orthogonality of each successive principal component. The object of this method is to obtain components which account for most of the variation in the original variables. If successful, we will have reduced the dimensionality of the FAI without a significant loss of information. Furthermore, this may lead to a better understanding of the original variables, in that it gives underlying structure to a seemingly amorphous group of variables.

The purpose of principal components analysis is to represent the thirty FAI attributes in a smaller set of more basic or underlying functional categories. Thus principal components analysis attempts to reproduce, with a smaller group of variables, all the information contained in the original inventory. The first principal component extracts a certain percentage of the variance from the correlation matrix of the original FAI data. The second principal component is orthogonal to the first, and extracts less of the remaining total variance. Each successive principal component is orthogonal to the previous ones, and extracts successively less of the total variance. Since the variables were ...alized to the unit variance, the total variance of the correlation matrix of FAI attributes is thirty

units. If we extracted 30 principal components, we would account for all the variance in the standardized correlation matrix. Of course this defeats the purpose of the data reduction exercise. Using Kaiser's criterion, we decided to maintain a principal component as an explanatory variable only if it accounted for more than 1/30th of the variance, i.e. more than 1 unit of variance. Following this criterion, seven principal components were retained for use as explanatory variables in the earnings equation.

The seven principal components extracted accounted for 61% of the variance of the FAI data. The first four principal components extracted 19.7, 14.1, 9.0 and 5.8 percent of the variance respectively, or 48.5% cumulatively. The remaining three extracted less than 5% each. In general, each principal component weights more heavily a different aspect of functioning, yet some of the principal components overlap. Thus we cannot claim that each principal component clearly represents a distinct aspect of functioning. For example, the first principal component had nearly equal correlations with 13 FAI variables, ranging in value from two tenths to three tenths with such diverse aspects of functioning as emotional, mental and vocational. Only physical functioning was not correlated with this component. Recall that the first principal component extracted roughly one-fifth of the total variance. Although this summarizes more of the information than that extracted by

any of the subsequent prinicapal components, it still only extracts 20% of the information, not enough to provide a strong interpretation given the diffusion of the correlations between the component and the variables. The second principal component explains 14.1% of the variance, compared to the 20.1% of the first principal component. Ten variables are correlated .2 to .4 with the component. These comprise the areas of motor function and physical condition, different variables than the first principal component. Although this component explains a different aspect of functioning than the first component, it correlates weakly with too many variables to enable clear interpretation, similar to the problems associated with the first principal component.

The third principal component is orthogonal to the first two principal components, but partly overlaps with the relative weights of the first principal component. Four of the variables with the strongest correlation with the third principal component are also among the variables most highly correlated with the first principal component. Again the correlation values range from .2 to .4 for these four.

The fourth, fifth and sixth principal components account for a small amount of variance. They are negatively correlated with FAI attributes with which the previous three components were positively correlated. Furthermore the magnitudes of the

correlations were similar, albeit of the opposite sign, i.e. in the range of -.2 to -.4. Low FAI scores for clients should intuitively be negatively correlated with dysfunctioning. Thus it is not surprising that the later principal components are most strongly correlated <u>inversely</u> with the FAI data.

The seventh principal component correlates highly only with the vision variable. Thus vision as a type of functioning, appears to be unrelated to other measures of functioning, as expected.

F. Factor Analysis as a Health Variable.

The purpose of factor analysis is also to reduce the dimensions of the data to generate explanatory variables for the earnings equation. But while in principal components analysis we assume the entire variance can be explained, in factor analysis we make a prior assumption about the portion of the variance that is common to all variables (and implicitly the portion that is unique to each variable). In principal components analysis we seek to explain 30 total units of variance; in factor analysis some portion of this total variance is explained by a common structure, and the remainder is assumed attributable to unique elements of the 30 attributes.

The method of principal components involves generating an observable linear transformation of the variables such that the variance extracted from the data is maximized. All principal components must be orthogonal to each other (i.e. independent).

Beyond this, there is no formal model underlying this method of data reduction. As we have seen, the underlying components are not readily interpretable. In factor analysis, on the other hand, we estimate factor loadings, based on a model of the relation between underlying factors and the data. Furthermore, through various factor rotation techniques, it is possible to extract underlying factors which lend themselves to more meaningful interpretation than principal components. The concept of the underlying factor can be confusing, because of its unobservability and its hypothetical nature.

First we must specify the particular form of the factor analytic model to investigate the impact of FAI on earnings. The initial step is to make an assumption about the prior communalities, that is, about the amount of total variance common to all variables. Since the goal of the factor analysis is to derive final estimates of factor loads, we must first estimate the factor scores based on <u>assumed</u> communalities, then recalculate the final factor loads.

Factor analysis using principal factor analysis with prior communalities set equal to one , a quartimax rotation method and the Kaiser criterion of factor retention, gave seven factors. The Kaiser, or mineigen, criterion specifies that a factor be retained only if it contributes to the explanation of more than the average amount of variance. Since the thirty FAI variables

were normalized, the average amount of variance is one. Thus only factors extracting more than one unit of variance are retained. These factors have been assigned the names judgement, motor functioning, cognition, physical condition, communication, vocational qualifications and vision corresponding to the variables with the highest correlations with each factor. In general, we have applied the rule that a variable should be accounted for by the name of the factor if the correlation between that variable and the factor is greater than .5. This minimum level reflects the fact that the FAI attribute has a shared variance of at least 25% with the underlying factor (since a load is a correlation between a variable and the factor, which squared and summed yields the portion of the total variance explained by that factor). The seven factors explain 18.23 units of variance. Since there are 30 standardized variables, these factors explain 60.2% of the total variance.

Using the factors as explanatory variables in the earnings equation (Model 3, Table 13-9) gives a much different picture of the role of health in explaining client earnings. First, the overall explanatory power of the model is increased by roughly 50%, from approximately .25 in the previous models to .35 in the current specification. This dramatic improvement indicates the importance of appropriately specifying health or functioning. Thus there is much less unexplained variation in earnings as a result of this more exacting specification.

Six of the seven factors used as the basis for explanatory variables were significant at the 5% level: four of these were significant at the 1% level. For these six the parameter estimates were of the expected negative sign. That is, since greater loss of functioning corresponds to higher FAI scores, the negative sign on the "health" variables implies that an increase in the score results in lower earnings at closure. The perverse sign and statistical insignificance of the communication factor may be attributable to the limited dispersion in the scores for this regressor.

The magnitudes of the parameter estimates on the significant "health" variables range from -0.2142 (vocational qualifications) to -0.0573 (vision). The interpretation of these magnitudes is straightforward but instructive. A 1 unit increase in the score on the vocational qualifications regressor, for example, results in a 21.42% fall in earnings at closure. While at first glance this sensitivity appears great, when we recall how the score is obtained it becomes more plausible. Algebraically:

$$f = FR^{-1}x_i .$$

where f is the score data for each individual, F are the factor loads, R^{-1} is the inverse of the correlation matrix, and x_i are the FAI variable scores. The factor loads generally do not exceed 0.8, and the correlation matrix elements never exceed 0.5. Thus, using this extreme case as an example, to have a 1 unit

increase in the regressor score would require a 25 point increase in overall FAI rating. Similarly a one unit rise in the score on the vision regressor reduces earnings at closure by 5%.

The strong significance of the seven "health" variables generated from factor analysis indicates the superiority of this specification over the two previous specifications of the FAI analyzed. In the fully disaggregated case only z variables were significant, and potential multicollinearity was high. The fully aggregated specification of the FAI "health" variable implicitly assumes an equal impact on earnings for a one unit change in any of the FAI variables. From the factor-analytically based specification, we see that a one unit change in the FAI score on two different variables will <u>not</u>, in general, have an equal impact on earnings. Furthermore, the fully aggregated and fully disaggregated specifications do not raise the R^2 of the model over the one exclusive of a health variable. Thus the specification based on factor analysis appears to be superior to the alternatives.

While inclusion of a health variable in the model may, per se, be of interest, it is our intent to use it as a control, to isolate the impact of services on earnings. Without including a health variable, health is being "picked up" in either earnings at referral, the other explanatory variables or the error term. The factor-analytically based specification of the health variable appears to serve this function, and at the same time

alters the estimated impact of other explanatory variables. The parameter estimate on the education variable increased in magnitude by roughly 20%. The earnings at acceptance parameter estimate fell dramatically, from 0.0457 to 0.0266, or almost 50%. Earnings at referral probably embodies much of this correlation. This is a desired result, since we feel that the inclusion of the earnings at acceptance variable on the right hand side of the earnings equation incorporates unobservable simultaneity with latent variables.

Summary and Conclusion

This analysis uses an augmented state data base to examine the impacts of specific VR services, using a different measure of health than the one routinely reported on the R300 data set. This chapter uses a data set constructed from a sample of 1,670 clients accepted for services in Wisconsin in 1981. The data base consists of the Wisconsin R300 data enhanced with specific case service costs and a Functional Assessment Inventory.

With such a data set one can estimate the impact of specific services on earnings. As previously noted, this is a vast improvement over assessing the impact of "average" VR services on client outcomes. Clients with different disabling conditions received qualitatively different types of services. However, with only the R300 "health" variable - an impairment classification, there is no information about the severity of the

impairment for these clients. In the absence of a severity indicator, it was found that certain services provided to clients adversely affected earnings.

By incorporating a more comprehensive measure of health, the severity of an impairment can be controlled for in an earnings equation. Using a factor analytic framework seven measures of functioning were put into the earnings equation. Each of these measures of functioning was highly significant in "explaining" the earnings levels of successfully rehabilitated clients. It was also found that this model specification vastly improved the explanatory power of the earnings equation. Moreover, inclusion of this improved health measure corrected for the omitted variable bias that is inherent in the R300 specification and which led to the perverse results for the impact of the specific services.

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Chapter 14

ESTABLISHING A MINI-DATA LINK

David Dean and Robert Dolan*

Introduction

The VR measure of client earning at closure used by VR agencies consists of the weekly earnings of clients at a point 60 days after they commenced employment. This reported earnings figure forms the basis for "benefits" estimation in benefit-cost analyses of the VR program [Conley, Bellante, Worrall].

There are three types of problems encountered in using this measure for estimating the benefits of a regimen of vocational rehabilitation services. The first type of problem is concerned with technical issues involved in estimating lifetime benefits from a point estimate of earnings. The second shortcoming of the R300 database earnings figure is the inability to assign benefits to those clients not rehabilitated because there are no reported earnings for the necessary 60 days for such clients. A third deficiency is the inability of the VR program to examine the earnings levels of clients who apply for services but who are not accepted. This relates to the control group issue that plagues

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any analysis of VR which is undertaken in a non-experimental setting.

Let's examine each of these problems in turn. What is wrong with assigning lifetime benefits from the earnings figure reported upon program closure? Temporarily overlooking the fact that this measure is only applicable for those clients successfully rehabilitated, any projection is crucially dependent on the assumptions made. In the traditional analysis, the assumption is made that the person will work at the same job for the duration of their employment period. Second, it is implicitly assumed that the weekly earnings are for a forty hour work week for the entire year. It necessarily overlooks periods of unemployment and job turnover. Finally, it may be assumed that there is a constant rate of increase in worker productivity, and thus earnings, over time. With a disabled population the researcher must be concerned with aspects of depreciation of human capital due to the impairment. It is not at all clear that a positive rate of change in earnings can be assumed a priori. This becomes an empirical question that can be resolved by taking a better longitudinal look at the post-program earnings levels of these people.

The second deficiency of this measure is the inability to ascribe benefits to those persons not rehabilitated. A statistical method to estimate the magnitude of such benefits is examined in Chapter 9. The empirical support for this procedure

can be found in the SSA-RSA data link studies, which reported significant post-program earnings for these clients [Greenblum] on a macro level. It would appear that a micro-level examination of the post-program earnings of those clients not rehabilitated would be most useful in quantifying any such benefits.

As discussed earlier in this report, the third aspect of VR benefit accounting that needs improvement is in the area of control groups. We have already discussed the difficulties of establishing a control group, hence, we must investigate appropriate substitutes for the ideal control group. One such method is to examine the earnings of persons who apply for but are not accepted for services. This method has been incorporated in a previous study for a small sample of clients [Nowak, Englander].

Each of these shortcomings hints at a proposed solution - namely to resurrect the data link. Given the difficulties of collecting data link information on the individual client level on a national basis, an alternative was pursued. Using data collected on earnings by states for unemployment insurance purposes, it was possible to construct a state-level data link by merging this information with the data routinely collected by the state VR agency. The report that follows presents the results of such an endeavor.

The first section describes how the data set was constructed

and what additional data were generated. The second section examines the general results of the procedure and compares and contrasts the findings for the successes, non-successes and not accepted clients. Items such as the number of jobs held, earnings per job, number of quarters worked and earnings per quarter are investigated. The fourth section looks specifically at earnings for sub-sets of the three groups. For instance the earnings of persons not rehabilitated because they moved can be contrasted with persons whose disability was judged "too severe" to justify further efforts to successfully rehabilitate the client. In the final section, some conclusions and areas of further research are presented.

Section I - Constructing the Enhanced State Data Base

The augmented state data base that has been constructed consists of 17,622 clients closed from counselors' caseloads of the Virginia Department of Rehabilitative Services (VDRS) during the period October, 1981 through September, 1982. In order to track these clients' post-program earnings through records kept by the Virginia Employment Commission (VEC) it was necessary that the client had a valid social security number. Since there were some 205 clients who had been issued temporary numbers by the VDRS, these clients could not be tracked. This left a total of 17,417 records that were submitted to the VEC for them to match with their records.

The VEC maintains on-line records of all persons working in "UI-covered" employment for a period of five quarters. For a record to be generated the employer must contribute some portion of the employee's wages to the Virginia Unemployment Insurance Trust Fund. At the time of the data request, the time frame covered comprised all four quarters for calendar year 1984 and the first quarter of 1985. Thus the post-program employment data that was obtained ranged from a minimum of 15 months for any clients closed in September of 1982 to a maximum of 27 months for those clients closed from services in October of 1981.

The information collected for each job reported consisted of the employer name and serial number, the quarters that the client

may have worked for this employer during the five quarter interval and the total earnings reported during any of these quarters worked. Unfortunately, there were no data recorded on either the hourly wage rate or the number of hours worked during the quarter.

Since some clients held several jobs during this interval, there were multiple records reported for these people. With the file of 17,417 VDRS clients, the VEC was able to track 12,044 job records for 6,709 clients at an average earnings of $4,108 per job. Thus, earnings data was generated from this procedure for 38.5% of the clients who were terminated from further VR services in 1982.

Possible explanations for the lack of reported earnings for the rest of the sample are threefold. First, it is likely that the people were either unemployed or had dropped out of the labor force entirely. Secondly, it is possible that the people were working but not in occupations covered by unemployment insurance. Finally, the client may be working out of the state, and thus outside the jurisdiction of the VEC. In the absence of a more comprehensive earnings record, such as the Social Security Master Beneficiary Record, any surmisals about the percentage breakdown of those not reporting into the respective categories would be sheer speculation at this time. As a consequence, the scope of this report must necessarily be focused on these clients who have reported earnings.

Section II - Examining the Overall Results of the Wage Match

There are numerous ways by which one can fruitfully examine such information on post-program earnings. For instance, one can get some idea of worker movement by examining the number of jobs held by a worker during these five quarters. One can get a crude proxy for worker productivity by investigating the quarterly earnings at each of these jobs. Information about labor force participation can be discerned by looking at the number of quarters worked during this interval. Finally some notion of worker skills and overall level of labor market success can be gleaned from an examination of the quarterly earnings for the clients who worked during any of the five quarters. Each of these aspects of employment are presented in Tables 14-1 through 14-4 below.

One of the more striking findings of the VEC-VDRS wage match is the transient nature of employment for these people. If the client worked at all during the five quarter period, an average of 1.8 jobs were held. Of course, this average figure is comprised of three distinct cohorts - those successfully rehabilitated, those not rehabilitated and those not accepted for services. The number of jobs reported for each of these cohorts as well as the entire sample are reported in Table 14-1.

Table 14-1

NUMBER OF JOBS HELD FROM JANUARY 1984 THROUGH MARCH 1985 BY PERSONS CLOSED FROM THE VIRGINIA DEPARTMENT OF REHABILITATIVE SERVICES DURING FISCAL YEAR 1982, IF REPORTING ANY JOBS

Number of Jobs	Persons Rehabilitated	Percent of Total	Persons not Rehabilitated	Percent of Total	Persons not Accepted for Services	Percent of Total	All Persons Closed from the Program	Percent of Total
One	1583	60.6%	560	52.2%	1470	56.4%	3817	57.7%
Two	587	22.5%	256	23.9%	597	22.9%	1517	[illegible]
Three	244	9.3%	127	11.8%	28[illegible]	10.8%	688	10.4[illegible]
Four	120	4.6%	70	6.5%	144	5.5%	[illegible]	[illegible]
Five	40	1.5%	30	2.8%	59	2.[illegible]%	[illegible]	[illegible]
Six	22	0.8%	18	1.7%	30	1.2%	[illegible]	1.1%
More than Six	15	0.6%	11	1.0%	25	1.0%	5[illegible]	0.8%
Total Jobs	2611	100.0%	1072	100.0%	260[illegible]	100.0%	6519	100.0%

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Before examining the number of jobs for those who worked, perhaps it would be useful to look at the percentage of clients not working within each of the subgroups. We have already seen that less than 40% of the entire sample was tracked by the wage match procedure. By looking at the clients reporting positive earnings at their jobs, it was found that 51.3% of the successfully rehabilitated (status 26) cohort reported at least one job with the VEC earnings file. This contrasts sharply with the 31.9% of clients tracked for those not accepted for services (status 08) and only 26.7% for those not rehabilitated (status 28 & 30).

If one were to assume that those not on file with the VEC were not working, then one could conclude that a client in the success cohort was twice as likely to be employed as a client not successfully rehabilitated. On the other side of the coin, the fact that only half of the successes were working during a period starting 1-1/2 years after they were closed status 26 does not say much about their "stick-to-itiveness". Of course, one must remember that the time frame being studied came in the midst of the 1982-1983 recession. Given that the "last hired" are usually the "first fired", this low percentage of clients reporting any employment at all can be viewed in a different light.

Not only were the successes more likely <u>to</u> work, but <u>when</u> they worked these clients tended to stay at the same job. The

Table 14-2

EARNINGS FOR EACH JOB HELD FROM JANUARY 1984 THROUGH MARCH 1985 [illegible]
CLOSED FROM THE VIRGINIA DEPARTMENT OF REHABILITATIVE SERVICES
DURING FISCAL YEAR 1982, IF REPORTING ANY JOBS

Number of Job Reported	Persons Rehabilitated	Percent of Total (N=2617)	Persons not Rehabilitated	Percent of Total (N=1097)	Persons not Accepted for Services	Percent of Total (N=2649)	All Persons Closed from the Program	Percent of Total (N=6709)
First Job:								
Average Earnings	$7,012		$3,903		$5,328		[illegible]	
# Reporting Earnings	2,583	98.3%	1,064	97.0%	2,567	[illegible]	6,539	97.5%
Second Job:								
Average Earnings	$3,506		$2,143		$2,676		$2,893	
# Reporting Earnings	1,023	38.9%	508	46.3%	1,130	[illegible]	[illegible]	41.5%
Third Job:								
Average Earnings	$2,147		$1,413		$1,762		[illegible]	
# Reporting Earnings	443	16.9%	254	[illegible]	548	[illegible]	[illegible]	[illegible]
Fourth Job:								
Average Earnings	$1,603		$1,194		[illegible]		[illegible]	
# Reporting Earnings	203	7.7%	127	11.8%	[illegible]	[illegible]	[illegible]	[illegible]
Fifth Job:								
Average Earnings	$1,835		$923		[illegible]		[illegible]	
# Reporting Earnings	87	3.3%	63	5.7%	124	[illegible]	281	[illegible]
Sixth Job:								
Average Earnings	$1,724		$1,072		[illegible]		[illegible]	
# Reporting Earnings	41	1.6%	31	2.8%	[illegible]	[illegible]	[illegible]	[illegible]
Seventh - 13th Jobs:								
Average Earnings	$1,739		$1,065		[illegible]		[illegible]	
# Reporting Earnings	42	1.6%	[illegible]	2.5%	[illegible]	[illegible]	[illegible]	[illegible]
All Jobs:								
Average Earnings	$8,861		$5,355		$6,906		[illegible]	
# Reporting Earnings	2,627	100.0%	1,097	100.0%	2,649	100.0%	6,709	100.0%

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rehabilitated cohort held only 1.69 jobs, on average. The typical non-success and not accepted clients worked at 1.94 and 1.82 jobs respectively during this five quarter interval.

This employment-transience indicator is illustrated in Table 14-1. It should be observed that just over 60% of the status 26's held one job. This is contrasted with 52% and 56% for the not rehabilitated and not accepted for services cohorts. Conversely, while almost one out of every four status 28 & 30 clients held more than two jobs during this time frame, only one out of every six status 26 clients held more than two jobs. This may indicate that the successfully rehabilitated client experienced a longer period of job tenure after completion of the program. Without data for earnings in 1983 it is not possible to tell whether or not clients have switched jobs during the interval from the time of program termination through January of 1984.

Not only was the successfully rehabilitated client more likely to have a stable employment record after closure from the program but they also earned more at these jobs. From Table 14-2 it can be seen that the average earnings for <u>all</u> jobs held during the five quarter period were $8,861 for the status 26 closures. The reported earnings figures for the status 28 & 30 closures and 08 closures for the same period were $5,355 and $6,906 respectively. Taking the earnings for the three cohorts for the first job worked at during this period as a percentage of these total earnings, we see that 80% of the successful cohorts'

earnings came from their initial job reported. This figure is higher than the non-successes and not-accepted cohorts which were 73 and 77% respectively.

This same pattern holds for clients who held more than one job during this period. While rehabilitated clients were less likely to have more than one job, if they did work at other jobs during this interval they earned significantly more. These results must be interpreted with caution. It should be noted that the data only reports on total earnings during a particular quarter. It cannot be discerned whether a client held jobs consecutively - demonstrating worker transience - or concurrently, in which case the client was "moonlighting".

We can get some notion of overall labor force participation <u>for clients who worked at least sometime</u> during the five quarter period by looking at the number of quarters worked. The successfully rehabilitated client, was employed, on average, in just under four of the possible five quarters. The persons who were not accepted into the VR program worked in just under three and one-half of these quarters. Persons not rehabilitated only worked in 3.2 quarters, on average.

The pattern of labor force participation for the three cohorts and the combined sample is reported in Table 14-3. Note that almost 55% of the successful cohort worked at some time in each of the five quarters. This contrasts with under 40% for

Table 14-3

NUMBER OF QUARTERS WORKED DURING THE FIVE QUARTER PERIOD BEGINNING JANUARY, 1984 BY PERSONS CLOSED FROM THE VIRGINIA DRS DURING FISCAL YEAR 1982, IF REPORTING ANY JOBS

Number of Quarters Worked	Persons Rehabilitated	Percent of Total (N=2611)	Persons not Rehabilitated	Percent of Total (N=1072)	Persons not Accepted for Services	Percent of Total (N=2607)	All Persons Closed from the Program	Percent of Total (N=6619)
Only One Quarter	291	11.1%	220	20.5%	413	15.8%	989	14.9%
Two Quarters	221	8.5%	191	17.8%	413	15.8%	873	13.2%
Three Quarters	281	10.8%	151	14.1%	[illegible]	12.4%	[illegible]	12.3%
Four Quarters	395	15.1%	172	16.0%	433	[illegible]	[illegible]	15.8%
All Five Quarters	1,423	54.5%	338	31.5%	[illegible]	[illegible]	[illegible]	43.8%
Total	2,611	100.0%	1,072	100.0%	[illegible]	[illegible]	[illegible]	100.0%

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those not accepted for services and only 31.5% of the not rehabilitated cohort. Conversely, while over 38% of the not rehabilitated clients worked only one or two quarters, 31% of the clients not accepted for services worked in less than three quarters. Less than 20% of the successfully rehabilitated cohort who worked reported earnings in two quarters or less.

Perhaps the most telling statistic about the overall productivity of persons closed from services during 1982 is their earnings for each quarter during the five quarters of the wage match. These results can be found in Table 14-4. The status 26 cohort averaged earnings of just under $9,000 during this period. If such a client worked during any particular quarter during this interval, earnings averaged between $2,121 and $2,427. The proportion of rehabilitated clients working during each quarter averaged about 80%, except during the last quarter when it dipped to only three-fourths of the cohort.

Note the general increase in quarterly earnings, which reached a peak in the last quarter of 1984 and then declined in the beginning of 1985. This may indicate an increase in hourly wages, hours worked or both. One simply can't tell with the given data. Given the prevalence of entry-level wages generally received by the disabled VR client, it would seem to indicate clients increasing their hours worked and then cutting back on them for the first quarter of 1985.

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Table 14-4

QUARTERLY EARNINGS AND NUMBER OF PERSONS WORKING DURING THE FIVE QUARTER PERIOD BEGINNING JANUARY, 1984 BY PERSONS CLOSED FROM THE VIRGINIA DRS DURING FISCAL YEAR 1983, IF REPORTING ANY JOBS

Period Worked, Average Earnings	Persons Rehabilitated	Percent of Total (N=2611)	Persons not Rehabilitated	Percent of Total (N=1072)	Persons not Accepted for Services	Percent of Total (N=2607)	All Persons Closed from the Program	Percent of Total (N=6619)
1st Quarter, 1984: Persons Working Average Earnings	2,041 $2,121	78.2%	643 $1,610	60.0%	1,742 $2,004	66.8%	4,628 $1,985	69.9%
2nd Quarter, 1984: Persons Working Average Earnings	2,089 $2,230	80.0%	668 $1,730	62.3%	1,840 $1,984	70.6%	4,824 $2,046	72.9%
3rd Quarter, 1984: Persons Working Average Earnings	2,101 $2,271	80.5%	699 $1,810	65.[illegible]%	1,865 $2,012	71.5%	4,895 $2,090	74.0%
4th Quarter, 1984: Persons Working Average Earnings	2,058 $2,427	78.8%	771 [illegible]	[illegible]	1,887 $2,076	[illegible]	4,895 [illegible]	74.0%
1st Quarter, 1985: Persons Working Average Earnings	1,982 $2,282	75.[illegible]%	[illegible] $1,661	63.[illegible]%	[illegible] $2,012	66.4%	4,60[illegible] [illegible]	69.6%
All Five Quarters: Persons Working Average Earnings	2,611 $8,915	100.0%	1072 $5,48[illegible]	100.0%	[illegible] [illegible]	100.0%	[illegible] [illegible]	100.0%

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the not rehabilitated group.

In particular, the total earnings for the five quarter period averaged just over $7,000, or just under $110 on a per weekly basis. This is less than 80% of the reported earnings for the status 26 cohort during the same period. However, for the individual quarters, the average earnings were closer to 90% of the rehabilitated cohort. It is worthwhile to note that the reported earnings showed very little variation from quarter to quarter, ranging from $1,984 to $2,076. The latter maximum average earnings figure was reported during the last quarter of 1984.

The labor force participation rates of the not accepted cohort for the quarters comprising this interval ranged from 66.4% to 72.4%. These rates came during the first quarter of 1985 and the last quarter of 1984. There had been an increasing rate of labor force participation throughout 1984 for this group.

It is most interesting to note that for each group the highest earnings and labor force participation rates (except for the status 26's) were generated during the last quarter of 1984. Not only were more persons working, but when they worked they worked more hours - assuming entry-level wages. This is probably attributable to the seasonal increase in employment always observed for this period from October through December. Again, this indicates the tenuous nature of employment for persons who apply for VR services.

All told there were 5,089 clients rehabilitated in 1982. There were 81 clients in either the BEP or unpaid family member status. A total of 609 of the closures were into homemaker status. These clients did not have any wages upon completion of the program; nor did the 180 some clients who were closed as students or trainees. Since we seek to contrast the earnings at the two different periods these persons were dropped from any further wage analysis. This reduced the relevant sample to 4,480 clients. The lion's share of clients were placed in competitive employment, with a small number in either sheltered or self-employment. The labor market outcomes for these three groups are presented in Table 14-5.

Since well over 90% of the rehabilitated sample was competitively employed, these figures will closely resemble those for the entire cohort presented in the last table. Overall labor force participation was 62.2% for the competitively placed workers. Note that for the self-employed, total earnings, on average, were lower than the competitively employed by some $350. However, quarterly earnings were higher for each of the five quarters comprising this interval. This is due to the lower labor force participation rates for the self-employed, who worked only 3.5 of the five quarters while the competitive cohort worked, on average, in four quarters of employment.

The earnings and participation rates for those clients

closed into sheltered employment were dramatically lower than their competitively-placed counterparts. Just over one quarter of this cohort reported any earnings during the five quarters of the wage match. Total earnings for these persons were only one-third of the competitively placed. Weekly earnings for this cohort, if they worked at all, were less than $50.

Although earnings increased for each quarter for 1984, they fell precipitously in the fifth quarter, the first quarter of 1985. This may have been due to the influx of such workers which increased the participation rate but lowered earnings as they tended to work few hours. Note that these clients only worked in half of the quarters and that they tended to be at the same employment. One could surmise that these rehabilitated clients were placed into "terminal" workshops from where it was difficult to move into competitive employment. To ascertain this requires further examination into the employer serial numbers.

A different line of analysis for rehabilitated clients involves transforming the quarterly and total earnings figures into weekly averages (by dividing by 13 or 65 weeks). This figure can provide a crude measure of the change in earnings for clients from the time of closure to the time of the wage match.

At the time of program termination, the average weekly earnings for all 4,480 status 26 closures were $144. For those clients still working during the first quarter of 1984 the average weekly earnings were $163. These 2,041 clients averaged

$153 per week when they were closed rehabilitated. Thus, this could be cautiously construed as a $10 per week change in earnings, an increase of 6.5%. Similarly, for those clients working during the first quarter of 1985, there was an increase in earnings of $23 over earnings at closure. This represents an earnings increase of 15.1% during this roughly three year interval.

Given the entire five quarter interval, there were greater numbers of persons who worked at some point; that is, the chances of a client working at some time during the 65 week interval were much greater than during a 13 week period. This increased the prospects of persons with lesser degrees of labor force attachment to work at some job. As a consequence, the transformed weekly earnings for the 65 week interval for the 2,611 clients tracked by the VEC were only $137. Earnings at program closure for this group were just under $150. Hence we see that, overall, weekly earnings fell by $13, a decrease of 8.7%.

Of course this indicated decline in worker earnings could represent lower wages per hour, less hours worked per week than at the time of program closure, low labor force participation during this particular year and a quarter, or a combination of all three. In the absence of data on hours worked and wages for these hours it becomes difficult to accurately attribute this decline in earnings to any one facet of labor supply.

We can also learn a bit more about the nature of the earnings for persons who were not accepted into the VR program as well as persons who were not rehabilitated after being accepted. For any person closed from the program the VR agency requires that the counselor provide a reason for the termination. The agency has nine classifications for why an applicant was not accepted for services and a subset of seven of these for why the client was closed not rehabilitated. The two additional categories are concerned with eligibility criteria. It would be quite fruitful to examine these people's later earnings, or lack thereof, in light of the reason why they were closed from the agency caseload.

To be accepted as a candidate for VR, it is necessary that a person have a medically-determined impairment that presents a vocational handicap that can be remediated through the provision of VR services. Following well-defined guidelines, a counselor can make the decision to not accept an applicant if it is found that there is no disabling condition, that the condition does not present a vocational handicap, or if the disability is too severe for the agency to undertake a regimen of services to attempt to rehabilitate the client. A counselor may transfer the case to another agency that is more appropriate. In addition to these four counselor determinations, there are numerous ways that a person can "self-select" out of the program. For instance, one could move, refuse services or be uncooperative, be

institutionalized or simply die.

Once the client has been accepted into the program, the counselor can only terminate the client from the program via transferring the case to another agency or deeming the client too severely disabled to warrant further expenditure of funds for services. A client may opt not to continue to <u>participate</u> in the program for the same reasons (stated above) for choosing not to be <u>accepted</u> into the program.

The results of the wage match process classified according to these closure reasons are presented in Table 14-6 for those persons not accepted for services and Table 14-7 for those clients not rehabilitated. It must first be noted that the last column consists primarily of 595 persons who were tracked by the VEC wage match but for whom a reason was not reported for their not being accepted for services. Slightly more than half of these people were tracked in the wage match. While this group had substantial earnings, averaging some $7500 for the five quarters of the wage match, there is not much else that can be inferred about this group in the absence of a reason for not being accepted.

The highest earnings levels were reported by those persons not accepted because they didn't have a vocational handicap. Participation rates were also among the highest reported. Almost two-thirds of this group was successfully tracked by the VEC.

Table 14-6

EXAMINING THE EARNINGS AND LABOR FORCE PARTICIPATION RATES OF PERSONS NOT ACCEPTED FOR SERVICES, BY CLOSURE REASON

Reason Person Not Accepted for Services

Category	Unable to Locate or Moved n=872)	Disability too Severe (n=849)	Refused Further Services (n=985)	Would not Cooperate (n=450)	No Disabling Condition (n=399)	No Vocational Handicap (n=614)	No Reason Given or Transfer, Died or Institutution (n=1220)
# with Earnings:	383	231	532	225	265	404	618
% Reporting any Earnings to VEC:	43.9%	27.2%	54.0%	50.0%	66.4%	65.8%	50.4%
1st Quarter, 1984:							
Average Earnings	$2,067	$1,547	$2,011	$1,584	$1,986	$2,[illegible]94	$2,069
% Reporting	27.5%	15.7%	35.0%	29.8%	48.1%	5[illegible].7%	34.4%
2nd Quarter, 1984:							
Average Earnings	$1,857	$1,739	$1,902	$1,758	$1,866	$2,[illegible]96	$2,146
% Reporting	29.7%	15.7%	38.4%	33.1%	52.4%	[illegible].8%	35.6%
3rd Quarter, 1984:							
Average Earnings	$1,838	$1,732	$1,981	$1,782	$1,891	$2,238	$2,205
% Reporting	31.2%	17.6%	38.1%	33.1%	52.4%	50.7%	35.4%
4th Quarter, 1984:							
Average Earnings	$1,943	$1,743	$2,004	$1,749	$2,143	$2,452	$2,125
% Reporting	30.8%	17.4%	39.0%	36.2%	51.[illegible]%	49.0%	36.6%
1st Quarter, 1985:							
Average Earnings	$1,[illegible]57	$1,685	$1,919	$1,789	$2,[illegible]	$2,247	$2,088
% Reporting	27.8%	15.7%	34.9%	31.1%	47.1%	46.6%	848.0%
Average Total Earnings:	$6,458	$5,082	$6,739	$5,668	$7,545	$8,525	$7,4[illegible]3
Average Weekly Earnings:	$99	$78	$115	$87	$116	$131	$114
Average Number of Quarters Worked:	3.3	3.0	3.4	3.2	3.8	3.8	3.5
Average Number of Jobs Held:	2.0	1.6	1.9	2.0	1.9	1.8	1.7

Table 14-7

EXAMINING THE EARNINGS AND LABOR FORCE PARTICIPATION RATES OF PERSONS NOT SUCCESSFULLY REHABILITATED, BY CLOSURE STATUS

Reason Clients Were Not Rehabilitated

Category	Unable to Locate or Moved (n=1001)	Disability too Severe (n=1181)	Refused Further Services (n=681)	Would not Cooperate (n=630)	Other (Transfer, Died or Institutution) (n=198)
# with Earnings:	326	151	269	283	43
% Reporting any Earnings to VEC:	32.6%	12.8%	39.5%	44.9%	21.7%
1st Quarter, 1984: Average Earnings	$1,883	$1,149	$1,709	$1,475	$1,007
% Reporting	20.3%	6.4%	26.0%	25.4%	14.1%
2nd Quarter, 1984: Average Earnings	$1,981	$1,344	$1,887	$1,462	$1,487
% Reporting	19.6%	6.4%	29.5%	26.5%	14.6%
3rd Quarter, 1984: Average Earnings	$2,198	$1,240	$2,039	$1,401	$1,663
% Reporting	20.9%	7.2%	28.9%	28.6%	14.1%
4th Quarter, 1984: Average Earnings	$1,911	$1,412	$1,950	$1,561	$1,311
% Reporting	21.0%	7.6%	28.6%	32.5%	15.7%
1st Quarter, 1985: Average Earnings	$1,910	$1,247	$1,860	$1,481	$1,066
% Reporting	20.8%	7.5%	26.3%	29.8%	14.1%
Average Total Earnings:	$6,222	$3,513	$6,679	$4,702	$4,381
Average Weekly Earnings:	$96	$54	$103	$72	$67
Average Number of Quarters Worked:	3.1	2.7	3.5	3.1	3.3
Average Number of Jobs Held:	2.0	1.6	1.8	2.1	2.1

This rate was higher than that reported by the competitively employed. For persons tracked, total earnings averaged over $8500. On a weekly basis this five-quarter figure translates into earnings of over $130.

One should remember that these people may indeed have had some disabling condition. In denying them eligibility, this condition was judged not to impair their employability by the VR agency. Such people may have been temporarily off their lifetime earnings' profile when they applied for services. After denial of services, such people returned to or found employment at a somewhat lower rate than rehabilitated clients. Therefore, it is not surprising to see these people with earnings comparable to the competitively-employed rehabilitated cohort.

The group with the second highest average earnings as well as the highest participation rate were persons judged by the VDRS not to have a disabling condition. On a weekly basis their earnings were just over $116 for the five quarter period. This cohort would also seem to have been temporarily off their expected lifetime earnings path. One could characterize this group as being "down on their luck" and with a minor impairment at the time of their application for services. After being denied VR services they eventually returned to the labor market, earning about $1000 less during the five-quarter period than those persons not vocationally disabled.

Each of the remaining reasons for not being accepted for

services is also a legitimate reason for not being rehabilitated. Let's then compare the labor market experiences for persons terminated for these reasons in tandem.

First we examine the cohorts that moved or the VR agency couldn't locate. Note that for the persons who moved after accepted for services, the labor force participation rate is lower - 44 versus 33%. Both groups earned between $6000 and $6500 for the five quarters of the VEC wage-match. This translates into earnings of slightly less than $100 per week. The not rehabilitated group also held slightly more jobs and worked fewer quarters than persons who moved prior to acceptance.

Given the paucity of information on the R300 dataset for persons who did not get into the program, we cannot make too many substantive inferences about differences between these groups. We do know one thing for certain. The people who moved after being accepted received a significant amount of VR services [see chapter 9]. By tracking clients via the wage match we now have data on both labor force participation and earnings. This enables the researcher to estimate the efficacy of the menu of services received by these people. Traditionally, such persons were considered not rehabilitated and that was the end of the story.

Let's next examine the groups that refused to be accepted into the program or refused further services once accepted. The

only trenchant thing to note about these two cohorts is their remarkable similarity. Except for a lower tracking rate by the VEC for the not rehabilitated cohort, there is virtually no difference in quarterly or total earnings, number of jobs held or number of quarters worked. The total earnings for those refusing further services, $6679, were the highest of all the reasons given for the status 28's & 30's. The very fact of their refusal implies that they found a preferable alternative to the IWRP offered by the VR agency. We can infer that this eventually led to their gainful employment.

The next group of interest are the clients who were deemed "uncooperative" when either they applied for services or after they started receiving services. For both of these cohorts roughly half were tracked through the wage match. Note that persons who started the VR program earned significantly less for the five quarters of the wage match, some $900, than those who were uncooperative before being accepted. Both groups exhibited relatively low earnings and quarters worked. They also had difficulty staying at a job - averaging two jobs for the period under study. This should not be surprising given the implicit counselor judgment that such clients were difficult to deal with and probably had some emotional problems that would tend to make them unemployable.

The final groups to be examined are those who were too severely disabled to either be eligible for services or to

continue further in the intended program. It should immediately be evident that such people are significantly worse off than the others. Their quarterly and total earnings, overall participation rates, and number of quarters worked if they worked at all were the lowest by far for all closure reasons given.

One of the most perplexing findings is that the "too severely disabled" client who was terminated from the program did significantly worse than the similarly classified client who was not accepted. The overall labor force participation rate reported by the VEC for not-rehabilitated clients was less than half that of those who weren't accepted. Moreover, for the few status 28 & 30 clients who worked, earnings were much less than those not accepted for the same reason. The former group had five-quarter total and estimated weekly earnings of $3513 and $54. These are dramatically lower than the $5082 and $78 for persons who did not enter the program.

This is anomalous for two reasons. First, the former clients of VR received large amounts of services. Given the outcome one would have to question the efficacy of the service provision. Secondly, one would expect that the people who never got into the program would be more severely disabled, and ceteris paribus, have lower earnings than those who were receiving services. The only possible explanation lies in the large numbers of both groups that didn't participate in the labor force

during the time of the wage match. It may have been that persons terminated after receiving services were better off but weren't able to obtain the necessary employment to demonstrate the improved functioning.

Chapter 15

CONCLUSIONS

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What's Wrong?

There are distinct limits as to what can be accomplished with the existing data base in the vocational rehabilitation program when it comes to the calculation of benefits and costs.

We have used multivariate analysis of individual data to standardize for the characteristics the client brings to the program. Everyone concedes that the highly educated person with a minor impairment is easier to rehabilitate than the severely handicapped persons with a grade school education. It is possible to use statistical techniques to standardize for these differences and to help isolate the treatment effect.

But the most sophisticated statistical methods cannot overcome some of the data problems:

1. Only a single data point relating to earnings of the client at time of referral is reported. For a substantial number of entrants, their reported wage at referral is zero.
2. Only a single data point is reported for earnings at closure, and no earnings are reported for persons who are closed out in a nonrehabilitated status.

3. Only crude measures of case services and disability status are available. No separate measures of counselor time and similar benefits are reported.

Three Types of Corrections

Put most simply, there are three methods of correcting for the absence of data. One is econometric, as with the corrections for zero earnings at referral and the imputation of wages for unsuccessful closures as is done in chapters 8 and 9.

A second method is more of a "cookbook" method, although some more elegant term might be applied. An example might be gleaned from the Orgeon model, or any one of a number of state models. Corrections are made in these models to account for the lack of permanence of job holding by successful rehabilitants, or for the adjustments to reported earnings at referral. The correction factor, usually applied across the board, is derived from some separate inquiry or study made in the state where the experience of one cohort was examined. This is denominated as a cookbook method only because it is assumed that the same recipe holds for the group under examination as for the group which was studied.

We use a variant of the cookbook method when we make assumptions as to the future course of earnings in the models estimated in chapter 7. In the absence of follow-up data, we have no way of knowing with any degree of certainty what future rates

of mortality or productivity will be, let alone future inflation and unemployment rates. We do make various estimates of these numbers and present the results of a sensitivity analysis showing the influence of the various assumptions on the benefit cost ratios.

We think there is a better way and our third method is to to use actual data where possible. First, we look at data normally and usually collected at the state level, but not reported on the R-300. Next, we examine the possibilities of using data from outside the program by use of data links and control groups. The use of several of these collected non-R300 items, cost of services, counselor time and similar benefits are demonstrated in chapter 12.

Examining the Rehabilitation Process

The use of these data opens up the possibilities of examining the whole anatomy of the rehabilitation process. A client does not simply walk into a rehabilitation agency and then walk out again after 18 months, cured or not cured. Quite different kinds of services are given to clients and it is reasonable to suppose that they have quite different effects on different clients. What is exciting about our look at the efficacy of services is that it makes this type of analysis useful for managerial and allocation decisions. The future of benefit cost analysis will lie in demonstrating to those who run the programs that this is a

useful tool, not only for evaluation but for management at the state, regional and office level, and at the level of individual case management as well.

One of the grave difficulties of fashioning a control group composed of persons who do not apply to the program is that the accepted program applicants are disabled and it would not be fair to match them with nondisabled persons. We have some information about disabled persons from some national surveys, but the difficulty in matching comes from our lack of knowledge about the severity of disability of the program applicants and the persons surveyed.

What is needed is some measure of disability status, of functioning, of residual working capacity--call it what you will, which can be used to standardize for what we have chosen to call in chapter 13, health status. We present the results of standardizing in one state, Wisconsin, where information on the R-300 data, cost of case services and the functional assesssment scores are available. The measure we use, the functional assessment inventory is one of several possible measures which could be used to standardize for disabilities in a control group experiment.

We suggest one alternative of using an augmented data base for the state program and then fashioning a control group based on applicants to another program or persons who apply to the state employment service. Each of the persons would be

administered an FAI and the usual demographic and R-300 information would be collected.

Two research designs are possible. One would consist of the universe of clients in one year in one or several state programs. The other would consist of a sample of clients of the VR program selected on a nationwide basis but with attention to appropriate clustering so as to minimize survey costs. In either case, controls would be selected from among applicants to the state employment services or another appropriate program. Persons in both the control and the treatment group would be administered the FAI.

In either case, it is necessary to secure wage information on both groups, before and after the period of time the experimental group is receiving services. Follow-up surveys are preferable, but inevitably time-consuming and expensive. We have demonstrated in chapter 14 that it is possible to link RSA records with the wage information available from the state employment insurance programs. In that chapter we have contrasted earnings of rehabilitants with those of persons who applied for but never entered the program. As we recognized in our discussions of models in chapter 3, this is not an ideal method of constructing a control group. It would be preferable to construct a control group of applicants to another program and to secure comparable wage information for them from state

employment records.

Having such information for both a treatment and a control group sets the stage for the analysis. One of the models set forth in chapters 3 and 4 would be estimated using the methods set forth in chapter 7. To the extent data are missing, the econometric corrections described in chapters 8 and 9 might be used.

The SSA-RSA Data Link

The above models depend on forging minidata links at the state level. We have demonstrated their feasibility in one state but not all states keep wage information so that it can be recalled in timely fashion. Neither is it possible to trace all persons in the employment insurance records. Some persons work in employment which is not covered and some move on to another state and cannot be traced. A national data link of RSA and SSA records matches a higher proportion of cases and has the advantage of broader coverage and a nationwide scope. At one point in carrying out this study, it was thought that sufficient information could be garnered to demonstrate that it was feasible to apply one of the models to the national data link records.

We could not locate the computer tape of the prior data link studies. That tape apparently has been erased. The tabular information which is available does not permit the reconstruction of individual records such as would be necessary to estimate

multivariate models.

Our attempts to forge a new data link to test models on some sample and experimental basis ran into the obstacles of insufficient time and the confidentiality rules of the IRS and SSA. These are formidable obstacles, but they can be overcome. What seems clear is that it would serve little purpose simply to reconstruct the old data link with its tabular presentations. At a minimum, individual data on a machine readable basis utilizing the persons not accepted into the program as a control group is necessary. With such information the models presented in chapter 3 could be used.

Vouchers and their Alternatives

There are alternatives that go beyond the minimimally acceptable data link model. We present two scenarios. One would involve a true experimental design such as suggested in chapter 3. One group of clients would receive the usual services while another would be given vouchers for services which could be obtained from a variety of sources including private rehabilitation vendors. The ethical issues of denial of services would be overcome in such a design, but it would not be easy to overcome all of the possible administrative objections. The models we have sketched, the individual data we urge be collected, and the econometric methods we have delineated would have their maximum usefulness when applied to the information

from such an experiment.

If a true experimental voucher design is not feasible, is there a second best alternative? We think that such an alternative could be found in combining augmented and enhanced state data bases with SSA earnings records. This alternative requires systematic collection of case service costs, costs of counselor time, costs of similar benefits and some measure such as the FAI for all or a sample of clients. These data would then be combined with the usual R-300 data. We have demonstrated the feasibility of such a combination in Virginia and, in part, in Wisconsin. We are currently collecting and combining such information in California and Texas.

After such a data base is created, we propose that these records be matched with Social Security earnings records so as to obtain earnings at referral and several years of earnings after the date of acceptance into the program. We would not necessarily pay any attention to closure status, but would evaluate the efficacy of services given in relation to costs standardizing for disability status as well as the usual demographic and human capital attributes. We would use the clients accepted but not offered services as a control and would attempt to match wage profiles with other groups as a check on the primary analysis.

A Final Word

In this project, we have cleared away a lot of the brush. We have done some of the painstaking work in combining data sources, in reducing FAI scores to some measurable components, and in calculating costs of services. We think we have wrung dry the R-300 data set and have explored what states are collecting and how they are using benefit cost data. We have traced the uses of benefit cost information by administrators over the years and have examined the theoretical basis on which the whole edifice rests.

The groundwork has been laid and the foundations completed. Several promising alternatives are presented for anyone who wishes to know more about the costs and the benefits of this important program designed to bring hundreds of thousands of persons back to productive work.